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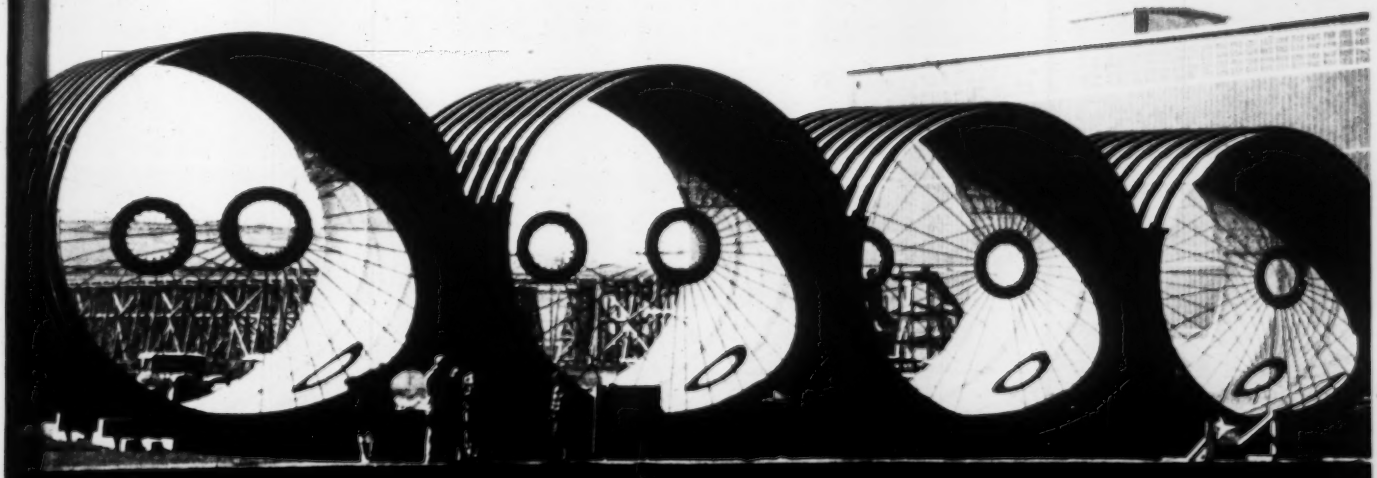

IN THIS ISSUE

Large Steel Penstocks for Fort Peck Dam—Underground Water Problems of Long Island—Design of Street Structures in St. Paul—Modern Building Design for a Small-Town Newspaper Plant—Tipton Sewerage System Modernized

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In Search of *Tomorrow's* Markets

FROM time to time this page reverts to the subject of obsolescence, that hidden destroyer of capital wealth. This is not to humor any personal whim; it reflects a conviction that obsolescence of capital facilities must play an increasingly important part in the industrial and financial practice of the period just ahead.

Everyone recognizes certain obvious forms of deterioration. When a machine or an overcoat wears out the fact is plain to see; when a building begins to rot, rust or crumble the destruction is evident. Such deterioration we accept as a part of everyday operating costs. We know that wear, tear and the elements consume our capital plant, so we either replace it out of earnings or accept the fact that our investment has depreciated in value.

But the ravages of obsolescence are more subtle. They are not manifest in the plant or equipment itself; these actually may be as good as ever they were. The losses may not even be apparent in current costs because savings elsewhere or higher revenues for the time being may conceal excessive costs due to inadequacy.

Unsatisfactory operating figures may be blamed on other factors: low selling prices; high prices for labor and materials; "cut-throat" competition; "unfair" or "subsidized" competitive products or methods. We seek our troubles anywhere except in the bare fact that our capital facilities, apparently as good as ever, actually may have fallen behind *as compared with more efficient facilities newly available.*

Fair competition implies no stable parity of competitive facilities; each producer must expect to compete *all the time* against the *very newest of plant, equipment, methods, materials and management that technical progress and business enterprise can evolve.* When he lets his own plant or practice lag behind that which is newest, he is lowering his guard by just that much. No one has a vested right to his place in the market; when he neglects to make rejuvenation of his capital facilities a first claim on his earnings, he is but consuming his principal and hastening the day when he must give up his unequal struggle against progress.

TECHNICAL progress is a great benefactor but in performing its function it becomes a ruthless destroyer of outmoded capital. That is why obsolescence becomes so dominant a factor throughout the sweep of American industry. More and more the market for capital goods will be one of replacement rather than of expansion, and more and more that replacement will be because of obsolescence rather than of physical wear and tear.

Today this principle is accorded increasing attention in the merchandising policies of progressive producers. A noteworthy example is that of an important manufacturer of electrical conductors, now engaged in a far-reaching program of promotion and advertising to demonstrate just what obsolete wiring is costing the power-user.

Many home-owners as well as industrialists take the wiring in their homes or their plants quite for granted. There it is, and copper doesn't wear out. But with new motors, new lighting, new processes and new appliances, they add increasing load and forget that in doing so they are making that wiring more and more obsolete, inadequate, wasteful and hazardous. Operating expenses are increased by the hidden losses caused by overloaded circuits; continuity of operation is subject to the risk of blowing fuses or breakers; security for the plant and those dependent on it for employment or earnings is menaced by increased fire hazards.

JUST as a man is as old as his arteries, this manufacturer asserts that any electrical installation is as old as its wiring. What is true of an electrical installation is equally true in every department of modern industry. What this wire manufacturer is doing to make customers and prospects more conscious of what obsolescence actually is costing them must be done on an increasing scale by every producer of capital goods and equipment.

This will involve study to determine the facts and persistent presentation of those facts to the responsible operating men of industry, through advertising and other forms of promotional effort. Only in proportion as this is done will the capital goods industries continue to find ample market for the genius and skill of their engineering and production staffs.

Willard Chevalier

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Table of Contents — See page 41

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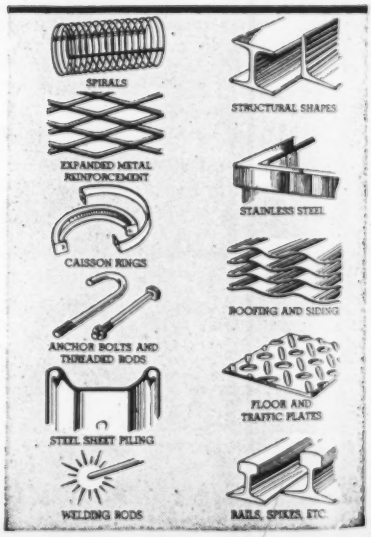

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MAY 13, 1937

Fort Peck Dam Penstock Lining . . . . . *Capt. A. W. Pence* 693

Long Island's Groundwater Problems . . . . . *Russell Suter* 697

Tipton Sewerage System Modernized . . . . . *Lew Richards* 698

Modern Design for Small-Town Newspaper Building 701

Design of Street Structure in St. Paul . . . . . *Geo. M. Shepard* 704

New Design for Sheepsfoot Rollers . . . . . *Paul Baumann* 707

Measuring Soil Moisture by Electric Current . . . *D. O. Ehrenburg* 708

Little Wear on Thin Concrete Bridge Floor . . . . . *George M. Buck* 710

Cantilever Floor Saves One Line of Columns 711

Marshall Ford Dam Designed for Future Raising 712

Current Notes on Sewage Disposal . . . . . *Willem Ruldolfs* 713

Letters to the Editor 714

From Job and Office 716

Editorials 718

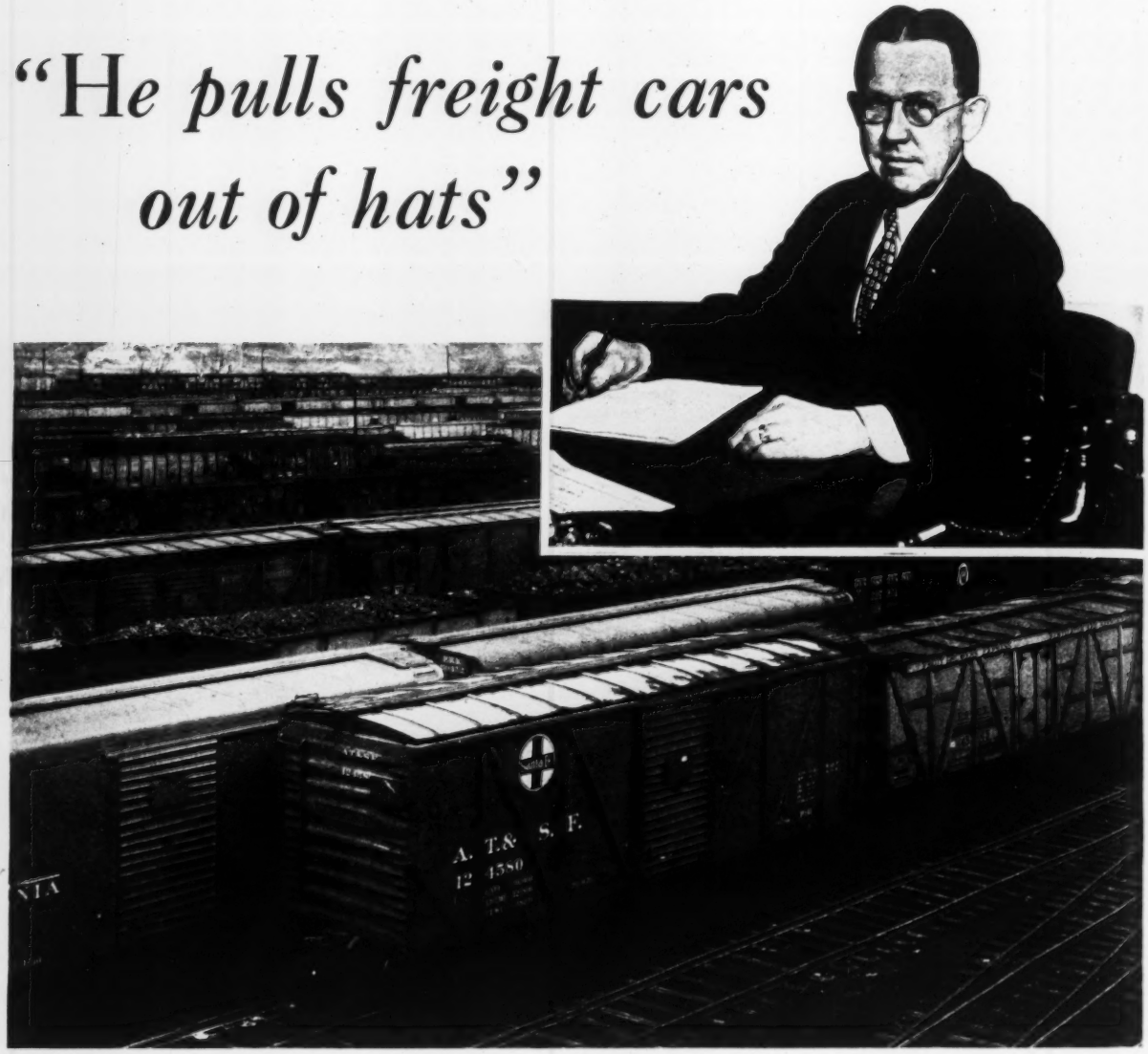
Current News 720

New Equipment 727

■

Road Growth and road use have increased at a rapid pace during the past two decades and the expenditures for roads likewise have expanded greatly, but statistics as to rate and character of this expansion are fragmentary. Next week's issue will contain a compilation of such statistics made by *Engineering News-Record* that is believed to be the most complete that is available.

"He pulls freight cars out of hats"



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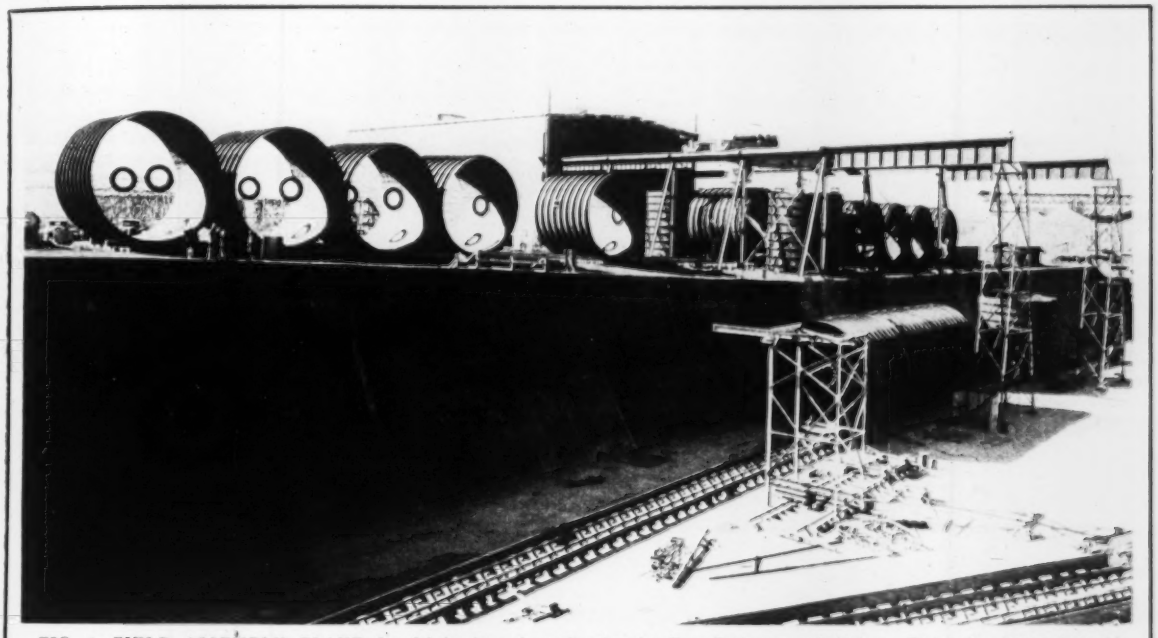


FIG. 1—FIELD ASSEMBLY PLANT for fabrication of steel tubes for Fort Peck penstock lining. Finished sections, braced by steel spiders, are transported into the tunnel on wide-gage carriages.

Large Steel Penstock Placed In Tunnel at Fort Peck

By Capt. A. W. Pence

Corps of Engineers, U. S. Army, Fort Peck, Mont.

ERECTION of a steel pipe, 24 ft. 8 in. in diameter, inside of the outlet half of Tunnel No. 1 on the Fort Peck project was rushed this past winter to permit completion of all four tunnels in time for diversion of the river during the coming dredging season. Upstream from the control shafts, near the axis of the dam, all four tunnels are lined with reinforced concrete to take full pool pressure. Downstream from the shafts, tunnels No. 2, 3 and 4 are concrete lined for free flow, but Tunnel No. 1 is receiving a special inner steel lining for use as a penstock in connection with possible future installation of a power plant at the outlet. Special handling rigs were developed for the assembly and erection of this large pipe within the tunnel.

General design

The tunnel is 32 ft. 2 in. excavated diameter (Fig. 3). The shale ground is braced with structural steel ring beams and purlins and lined with 21 in. of unreinforced concrete thoroughly grouted into the rock. Inside of this is placed a tube of 24 ft. 8 in. diameter, made of riveted steel plate varying in thickness from 1 in. at the control shaft to 1¼ in. at the outlet end. The tube is banded at intervals of 2 ft. 9 in. with 6-in. H-beam rings. Between the steel and the concrete lining the annular space of 23 in. is filled with concrete and grout, through which are provided four longitudinal drains to relieve any water pressure which might build up on the outside. Finally, the interior surface will be grit blasted and, to protect it from corrosion, will be coated with coal tar enamel 1/16 in. thick.

The steel lining (Fig. 2) extending 3,118 ft. from the shaft to the outlet, weighs 15,760,000 lb. and for erection purposes was divided into 126 sections, each about 25 ft. long. Each section was made up of nine plates, 8 ft. 4 in.x25 ft. 11 in., bent to the required radius across the long dimension. Three plates riveted end to end made a complete ring 8 ft. 4 in. long, and three rings riveted together make up a 25-ft. section of pipe. Successive rings and sections were assembled to bring the three longitudinal joints always at the invert and 120 deg. above on each side. Longitudinal joints were designed to develop the full strength of the steel, utilizing inside and outside splice plates and 1⅛-in. rivets. Transverse joints were made with outside splice plates and 1-in. rivets. For watertightness, the edges of the inner longitudinal butt plate and the inside of the transverse joint were given a seal weld. Also to give a tight job, rivet holes were reamed only 1/32 in. over the nominal diameter of the rivet. Stiffeners of 6-in. H beams were welded to the tube with intermittent welds along the edges of the inside flange.

Fabrication and assembly

A contract was let to the Chicago Bridge & Iron Co. for the fabrication of the steel and for the delivery of

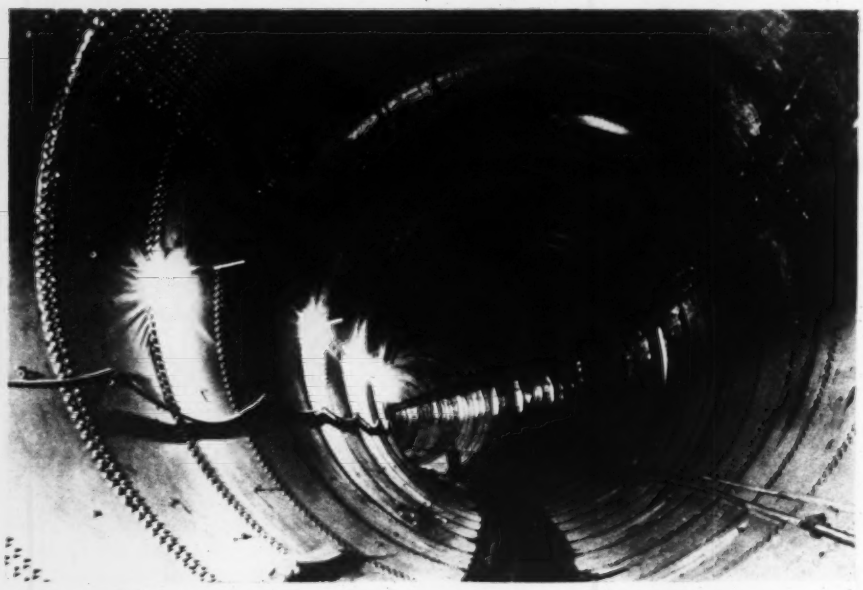


FIG. 2—CURVED SECTION of the completed tube near the outlet portal. The lining is 24 ft. 8 in. diameter and extends 3,118 ft. from control shaft to portal.

completed sections to carriages on a wide-gage railway on the floor of the tunnel outlet. At the main plant at Chicago, plates and beams were cut and cold rolled to the required radius and rivet holes were subdrilled. Sections were then assembled with bolts, holes for both shop and field rivets were reamed, part of the butt plates were riveted and part of the stiffener beams were welded on. The sections were then taken apart and shipped in gondola cars with the plates standing on edge.

At Fort Peck a plant (Fig. 1) was erected for the assembly and delivery of the completed sections which weighed up to 67 tons each. An overhead crane served a 96x160-ft. assembly building, a storage yard and the wide-gage (8 ft. 4 in.) track on which delivery was made. Eight sections could be assembled with axis vertical in the building, which gave protection against the extreme low temperature to be expected in a Montana winter. All rivets were driven with pneumatic riveting hammers and bucked with jam riveters. Rivets were heated by coke and given button heads outside and steeple heads inside.

All rivets were given the standard hammer test for tightness and an additional air test to determine leaks. The air test was applied with a special device which forced a pressure hood over a group of eight to twelve rivet heads on the inside of the tube. A soap solution was applied on the outside of the tube to all rivet heads and seams in the vicinity and air leakage was detected by the formation of soap bubbles. By adding glycerine to the soap solution, this test was carried on in temperatures as low as 20 deg. below zero. Experience showed that oxidation caused a marked reduction in the number of small leaks within a very few days.

After riveting, welding and testing were completed, the sections were fitted with eighteen-spoke spiders screwed into nuts welded to the interior surface of the tube. These spiders replaced 36-spoke spiders used for assembling of the units and were provided to make the sections hold their shape during storage, transportation and concreting. Completed sections were turned to horizontal position by means of a special hanger on the overhead crane of the assembly plant and then were rolled sideways from the craneway for storage.

Tube placement

Installation of the tube underground was done by government-owned plant and hired labor. The work progressed

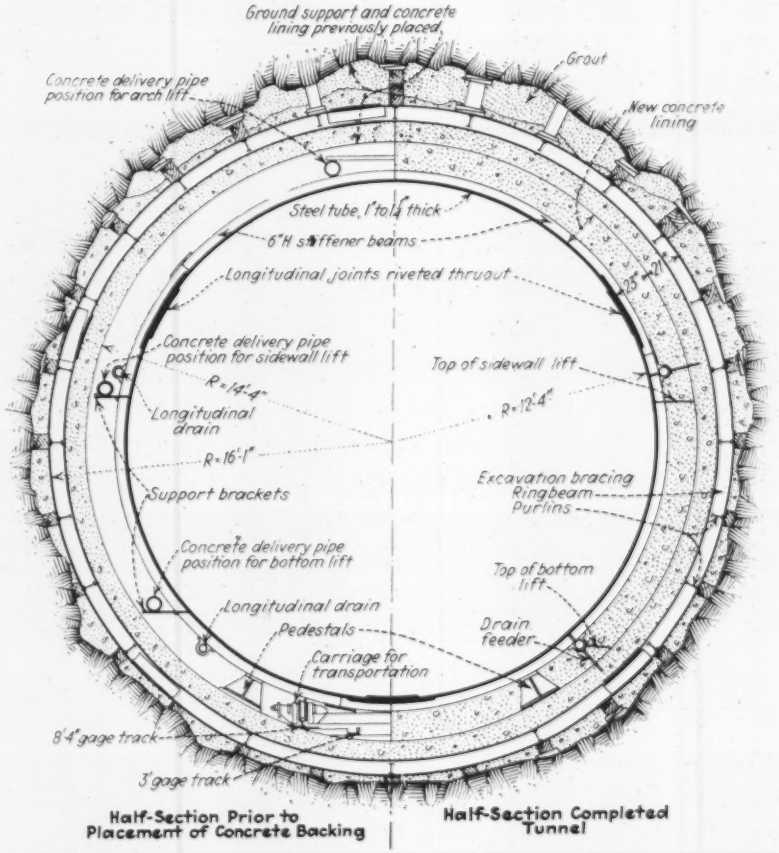


FIG. 3—THE STEEL TUBE was placed inside of existing concrete lining and the annular space between the two was filled with concrete placed by pneumatic blowers.

downstream from the shaft, the 25-ft. sections being carried into place by two special carriages, each equipped with four 9½-in. wheels on roller bearings running on the wide-gage track (Fig.

3). To permit accurate fitting, these carriages were equipped so the incoming section at each end could be raised or lowered, could be translated right or left or could be rotated. After fitting up was complete and the joint pinned and bolted, steel pedestals were shimmed and wedged tight under the tube and the carriage and track withdrawn. Motive power was furnished by a standard electric battery locomotive on a 3-ft. gage track located inside the wide-gage track and 4½ in. lower in grade in order to give clearance under the tube. A simple but ingenious switching arrangement at the

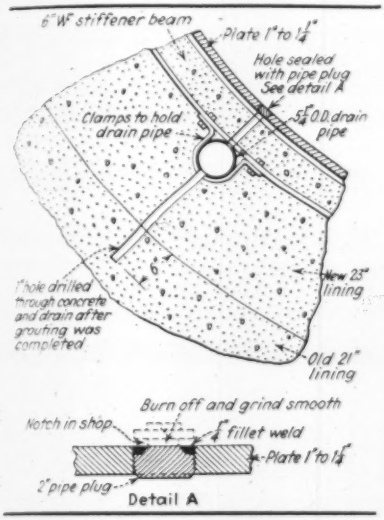

6" WF stiffener beam
Plate 1" to 1¼"
Hole sealed with pipe plug See detail A
Clamps to hold drain pipe
5" O.D. drain pipe
New 25" lining
1" hole drilled through concrete and drain after grouting was completed
Old 21" lining
Burn off and grind smooth
Notch in shop
⅜" fillet weld
Plate 1" to 1¼"
2" pipe plug
Detail A

FIG. 4—DRAIN PIPES will take care of any seepage water that might work its way between the concentric rings of lining. The drain feeders, shown here, were drilled after the tube installation was complete.

portal permitted the diversion of traffic off either the 3-ft. or the 8-ft. 4-in. gage on to a side line as needed.

It was found that the tube was too stiff to permit jacking to adjust to grade or alignment after the fit-up was complete. Accordingly each section was measured accurately before placement and shims, of various thicknesses not to exceed ¼ in., were tack-welded at appropriate points around the transverse field joint to give the correct position to the incoming section. Rivet holes at this transverse joint had already been reamed in Chicago, and therefore this practice sometimes gave unfair holes which had to be reamed in the field for oversize rivets. To overcome this difficulty, the reaming of this joint in Chicago was stopped and the sections thereafter came into the tunnel subdrilled only. It was also found that as successive sections were fitted together the vertical axis of the section, as fabricated, worked around until it was as much as 4 in. out of plumb. This gave no trouble on tangent sections of the tunnel, but was corrected by subdrilling and reaming one transverse joint in the field just before entering the curve near the outlet end.

Riveting of the transverse joint between sections underground was done with pneumatic hammers from the inside of the tube. Workmen in the annular space on the outside of the tube operated jam riveters bucked up against the 21-in. concrete lining. Rivets were heated by electricity in order to avoid contamminating the air supply with coke, oil or gas fumes. They were passed to the bucker-up by air pressure through flexible metal hose (Fig. 5). The spider rods gave excellent support for scaffolding for the riveters and supports were clamped to the stiffener beams for the bucking-up crew on the outside.

Concrete placement

As soon as three sections were riveted together underground, wooden bulkheads were erected at the downstream end and concrete placed for an advance of 75 ft. Placement was accomplished with two ¾-yd. pneumatic guns mounted on a heavy steel jumbo (Fig. 6). Two 6-in pipes 80 ft. long extended upstream from the jumbo to carry concrete into the annular space. The jumbo was parked outside the tunnel during steel placement. It was brought into the tunnel on two of the tube carriages on the wide-gage track, and just downstream of the tube it was set down on a temporary 80-ft. length of 14-ft. gage track. Movement of the jumbo on the 14-ft. track during placement operations permitted delivery from the end of the 80-ft. pipes to any point along the tube, and the pouring of concrete in horizontal layers. A light gantry running on the 14-ft. gage track supported the discharge pipes between the placement jumbo and the tube and also served to support the upstream ends of the pipes as the placement jumbo was being moved to and from the portal (Fig. 6).

Three shooting positions were arranged for the delivery pipes, one 6 ft. above the concrete invert for the bottom lift, one just above the spring line for the side-wall lift and a third just off the crown for the arch lift. The delivery pipes rested in light steel brackets welded to the stiffener beams for the bottom and side-wall lifts and on the stiffener beams themselves for the arch lift. For the first two lifts the pipes were fitted with torpedo shaped heads to avoid fouling the brackets or stiffener beams as the jumbo was run upstream. For 4 ft. back of the torpedo head, the bottom of the pipe was cut away to permit the delivery of concrete and to give a downward direction to the stream. For the arch pour the pipes were cut off square and the ends kept embedded about 6 ft. in concrete as the completed arch progressed downstream. A pause of 6 hrs. was made after the bottom pour to permit this concrete to take a partial set, thereby avoiding possibly harmful uplift pressures. Concrete was delivered from a plant at the outlet portal in 2-yd. buckets on 3-ft. gage trains. An electric trolley hoist in the top of the concrete jumbo handled the buckets from the train in the center of the tunnel invert to a position over gun hoppers located 9 ft. on either side of the center-line of tunnel.

FIG. 5—HOT RIVETS were delivered behind the steel lining by compressed air through flexible metal hose. The pipe in the left foreground is a longitudinal drain.

A complete cycle of operations for a 75-ft. advance, including movement underground of three steel tube sections, fit-up, driving 3,150 rivets, placement of concrete machinery, pouring 433 cu.yd. of concrete and removal of concrete machinery was finally worked down to a period of 2½ days. The whole placement job was completed in 4 months and 17 days. Subsequent to the pouring of concrete, holes through the steel lining in the invert and holes through the steel lining and the 23-in. concrete lining in the arch were grouted with 30 lb. per sq.in. pressure. The grout "take" averaged .62 cu.ft. per foot of tunnel in the invert and 1.89 cubic feet per linear foot of tunnel in the arch.

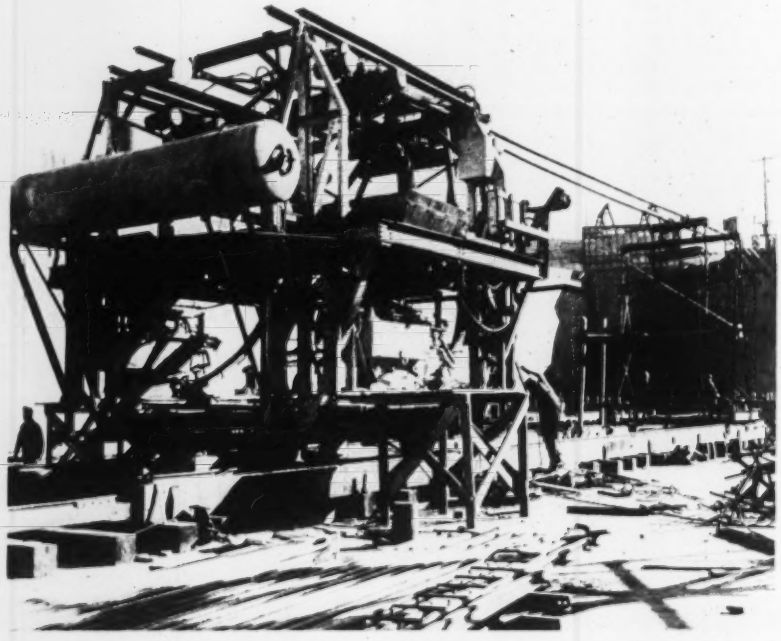


FIG. 6—CONCRETE PLACEMENT JUMBO, mounting two guns, is parked at portal while new sections are being moved underground. Note delivery pipes supported by light gantry in background.

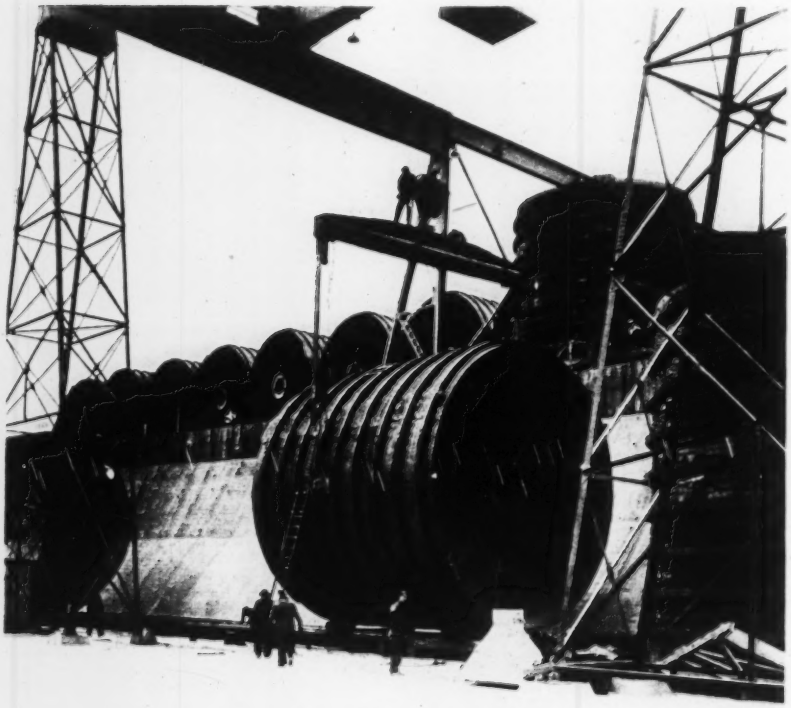


FIG. 7—SECTIONS WEIGHING 67 TONS were delivered to carriages by special hanger from the overhead crane.

Construction of drains

To prevent pressure from building up outside the steel lining due to leakage of rivets or other causes, four longitudinal drains were distributed around the circumference of the tube (Fig. 3). These drains consisted of 5¼-in. pipes clamped to the stiffener beams of each section to hold the drains in place during transportation and concreteing. During the concreting and grouting operations the drains were kept under water pressure and flushed occasionally to insure against leaks blocking the pipes with mortar. After concreting and grouting were completed, feeder holes were drilled every 25 ft. along each drain through the steel lining, back to the drain, through the drain and out 6 in. beyond the junction of the original and new concrete linings (Fig. 4). The hole in the steel lining was closed with a standard pipe plug fillet-welded around the top. These feeder holes provide for the relief of any pressure which might build up between the steel and the 23 in. lining or between the two concrete linings. At the downstream end all pipes were connected with a circumferential drain and an outlet provided to a sump.

Painting

Subsequent to grouting, the tunnel was thoroughly swept, spider nuts were removed, sharp edges were ground smooth and a solvent used to wash the surface free of oil and grease. A contract has been let for grit blasting throughout and the application of primer and a 1/16-in. coat of coal tar enamel. The finished job will be tested with a 5,000-volt potential to disclose pin points or "holidays" which must be done over.

The grit-blasting of 250,000 sq.ft. of interior surface of the pipe is being done with a crushed-steel product shot against the surface by compressed air at 80-lb. pressure. The operators wear pressure masks as a protection against dust. Following the grit blasting come painters applying a primer with spray guns. After the primer has set for 24 hr. a hot tar enamel is applied by brush. Enamel pots are electrically heated in pots controlled by thermostats to prevent overheating. The Standard Asbestos Manufacturing and Insulation Co., Kansas City, Mo., has the contract for the cleaning and painting.

Lt.-Col. T. B. Larkin, C. of E., is the district engineer supervising the work; Major Clark Kittrell, C. of E., is in charge of operations division and the writer is directly in charge of tunnel work.

Long Island's Groundwater Problem

Threatened destruction of the island's underground water supply through unregulated pumping from wells presents a grave question of public control.

By Russell Suter
Executive Engineer,
Water Power and Control Commission of the State of New York,
Albany, N. Y.

LONG ISLAND groundwater resources are being seriously injured and progressively destroyed by uncontrolled pumping. This destruction is spreading rapidly, threatens irreplaceable sources of water supply and calls for drastic and unprecedented measures of control.

Long Island is the coastal plain of the states of New York and Connecticut but is separated from the mainland by Long Island Sound and East River. It has a present population of over four million persons, about 88 per cent of which is in New York City. It is divided into four counties; two, Kings and Queens, constitute the boroughs of Brooklyn and Queens of New York City and two, Nassau and Suffolk, lie to the eastward.

Isolated water supply

Basement rock under the island outcrops along East River on the island and along the Connecticut shore line. This rock surface slopes to the southeast at the rate of more than 60 ft. to the mile and must be over 2,000 ft. below sea level near the center of the south shore of the island. On the rock is a deposit of gravels, sands and clays of Cretaceous age. The pitch of the successive strata lessens towards the surface. The whole is capped by glacial deposits and two terminal moraines. The topography is generally regular; the highest elevation is about 420 ft. above the sea.

As none of the unconsolidated strata cross the sound, this island is isolated as far as fresh groundwater is concerned. All such water must come from rainfall on the island. This mass of groundwater is surrounded by and frequently overlies salt water, but has irregular boundaries due to impervious layers between the lower beds.

Originally the former city of Brooklyn obtained most of its water from impounding reservoirs on streams along the south shore of Queens and Nassau counties. Most of these surface supplies have been abandoned and replaced by well fields in the same location. Elsewhere on the island nearly all water used comes from wells. Recently the tendency has been to seek the better water of the lower waterbearing beds.

Maps showing the upper groundwater levels for most of the island except Kings County were published in 1903. The 1903 contours for Kings and those of the existing upper groundwater for Kings and Queens counties were determined in 1933. The change shown was so great that the State legislature passed laws restricting well drilling on the island and later directed the Water Power and Control Commission of the state to report on the matter. This report has just been published. For this report the water levels over the whole island were determined late in 1936.

The information is best shown by models, photographs of which are given in Figs. 1 and 2. These do not include Suffolk County, where the change has been small. Sections showing the levels for different years are given in Fig. 4.

From Fig. 1 it will be seen that in 1903 the groundwater contours outlined a solid closely resembling the surface of the island in form. The highest point is a summit on the Nassau-Suffolk county line. On the other hand the contours for 1936 (Fig. 2) present an entirely different picture for the western end of the island. Within the city it would be impossible by study of the water contours to hazard a guess at the surface topography. All over Kings County the water table is below sea level, and it drops to El. —40 in the depression under the older part of Brooklyn. Much of Queens County is in similar condition. In Nassau County the levels have been lowered, and the former summit on the Suffolk County line has been depressed and moved south and east.

Sea water is flowing into these depressions. Most of the water under Brooklyn, much of that under Queens and some along the south shore of Nassau County has become too saline for drinking purposes. These effects are spreading at an accelerated rate as is known from comparison of the 1933 and 1936 contours.

Over-pumping and particularly industrial pumping, of magnitude unsuspected prior to 1933, is the cause of this condition, but the phenomena are too complex to be made clear by so simple a statement. Pumpage has increased as shown generally by Fig. 3 and for industrial use by Fig. 6. At the same time the safe yield of the western end of the island has been reduced by the building up of the territory and construction of streets and sewers, thus diminishing the groundwater recharge. In addition, the area of heavy pumping has been shifted from the more remote and pervious sections to the highly developed and impervious regions; deep-well turbine pumps have replaced the original suction pumps and air lifts, making it possible to pump water from great depths below the surface, and heavy pumping from the deeper strata has been practiced. Any pumpage lowers the groundwater at the well while the pumps are running and so must lower the average

THE AUTHOR SAYS:

Long Island groundwater resources are being seriously injured and progressively destroyed by uncontrolled and unregulated pumping.

* * *

The island is isolated as far as fresh groundwater is concerned. All such water must come from rainfall on the island.

* * *

All over Kings County the water table is now below sea level; it drops to El. —40 in the depression under the older part of Brooklyn. Most of the water under Brooklyn, much of that under Queens, and some along the south shore of Nassau County has become too saline for drinking purposes. Industrial pumping is responsible for the greater part of the trouble.

* * *

Effective control of the development of the groundwaters of the entire Island is essential. This will require enabling legislation, reinterpretation of the law as to percolating waters, and the development of a special engineering technique.

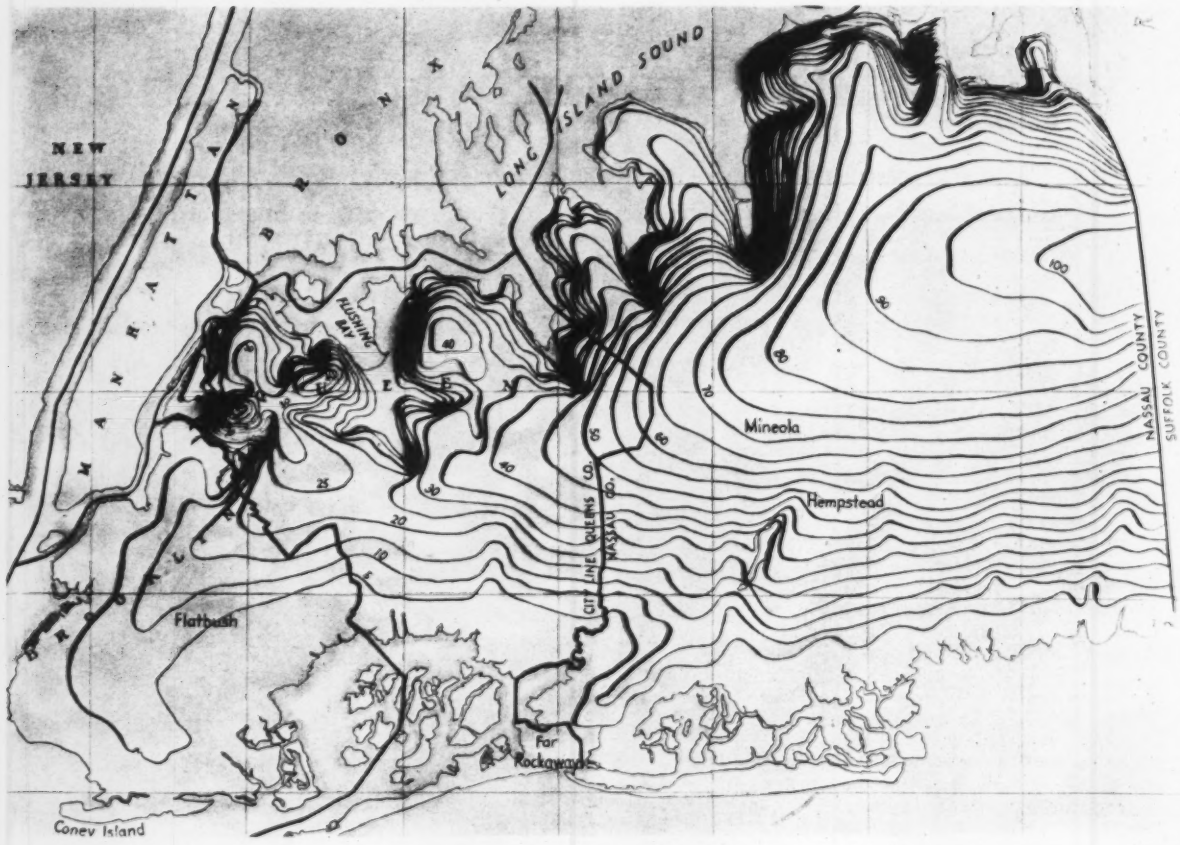


FIG. 1—LONG ISLAND'S GROUNDWATER HILLS in 1903 closely paralleled the surface hills.

groundwater level. This effect becomes cumulative as soon as pumpage exceeds recharge and is accelerated as the general lowering of the water table reduces the groundwater storage. In Brooklyn the critical point was probably passed about the year 1912 and the overdraft has continued since that time with the peak about the year 1929.

These groundwater contours are for the upper beds only. There is available but scanty information with regard to the lower beds and they may be in better or worse condition than is shown by the photographs. It is known that the water levels differ in the successive strata under a given point, but there is little accurate knowledge as to the interconnection of beds or as to the origin of the water in the lower beds or the points of recharge. Data with regard to the levels in the lower waterbearing beds and the extent and continuity of the impervious strata that separate them must be obtained before the subterranean hydraulics can be worked out. At least one continuous clay bed (Gardiners) exists under Brooklyn and Queens. Others are partly known. Possibly ancient stream valleys were cut down through the various strata and later became filled with pervious material and so form hydraulic connections between beds otherwise separated.

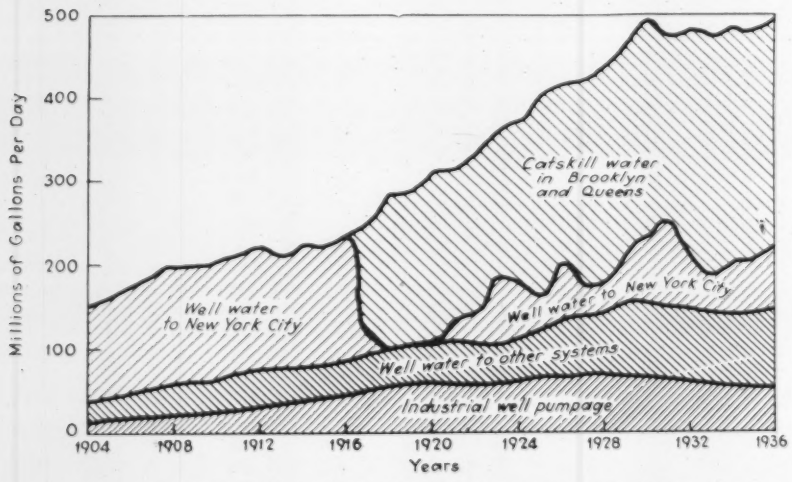


FIG. 3—TOTAL DRAFT on Long Island's groundwater exceeds 200 m.g.d.

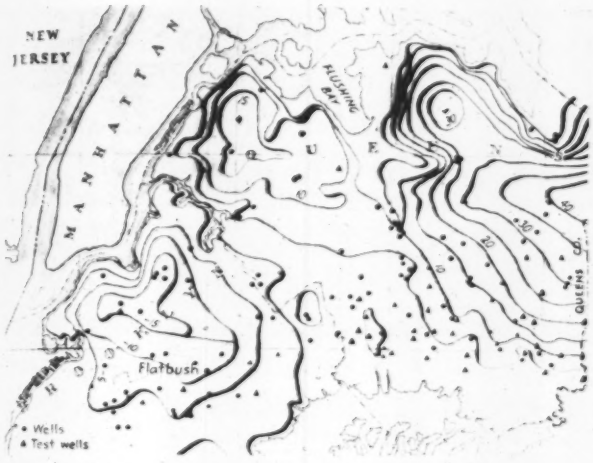
A buried river valley

One such valley is known (Fig. 5). The so-called Sound River valley cut through the Cretaceous deposits to rock and was later filled with Jameco gravels, which are cut off from fresh-water recharge by the overlying Gardiners clay. There is apparently a connection between this Jameco deposit and the Lloyd gravels, which supply the city of Long Beach. Due to over-pumping by the Flatbush plant of New York Water Service Corp. and by certain industries in Brooklyn, the waters in this Jameco formation have become saline. Under Queens the water levels (piezometric) in the Lloyd are below sea level, so salt water from the Jameco must tend to

flow through the Lloyd towards Long Beach.

Long Island's water resources

Rainfall on Long Island averages about 42 in. yearly. This is equivalent to about two million gallons daily to the square mile of superficial area, or 2,746 million gallons daily for the whole island. More than one-half of the rain is believed to enter the ground. Opinions differ as to how much of this water can be recovered by wells, but it is estimated that were the island developed as a unit a yield of 600 million gallons daily might be possible, which is nearly three times the present total pumpage. Thus, it is not the total volume of draft which causes the damage but the heavy concentration of that draft in the western end of the island, where the recharge is the least and the danger of salt-water penetration is great.



This concentration is shown by the accompanying tabulation, but for a true picture the figures in the last line should be weighted for variations in surface porosity.

Maximum development of the water resources of the island requires maintenance of a delicate balance between fresh and salt groundwater. Experience with regard to such operations is meager. This presents an intricate and unusual engineering problem and one of great economic importance but one that can be solved. Legal questions and vested rights seem a more formidable obstacle to the conservation of these water supply resources.

	Kings	Queens	Nassau	Suffolk	Total
Area, sq. mi.	71	108	274	920	1,373
Average pumpage, m. g. d.	62	65	77	15	219
Average pumpage, m. g. d. per sq. mi.	0.9	0.6	0.3	0.02	0.2

Present control limited

At present the only control is that exercised by the Water Power and Control Commission of the state, acting under two delegations of power:

1. No new public water supply wells can be put down until the commission has found that the proposed development will be fair and just to the other municipalities.
2. No wells of more than 100,000 gal. daily capacity may be put down, except

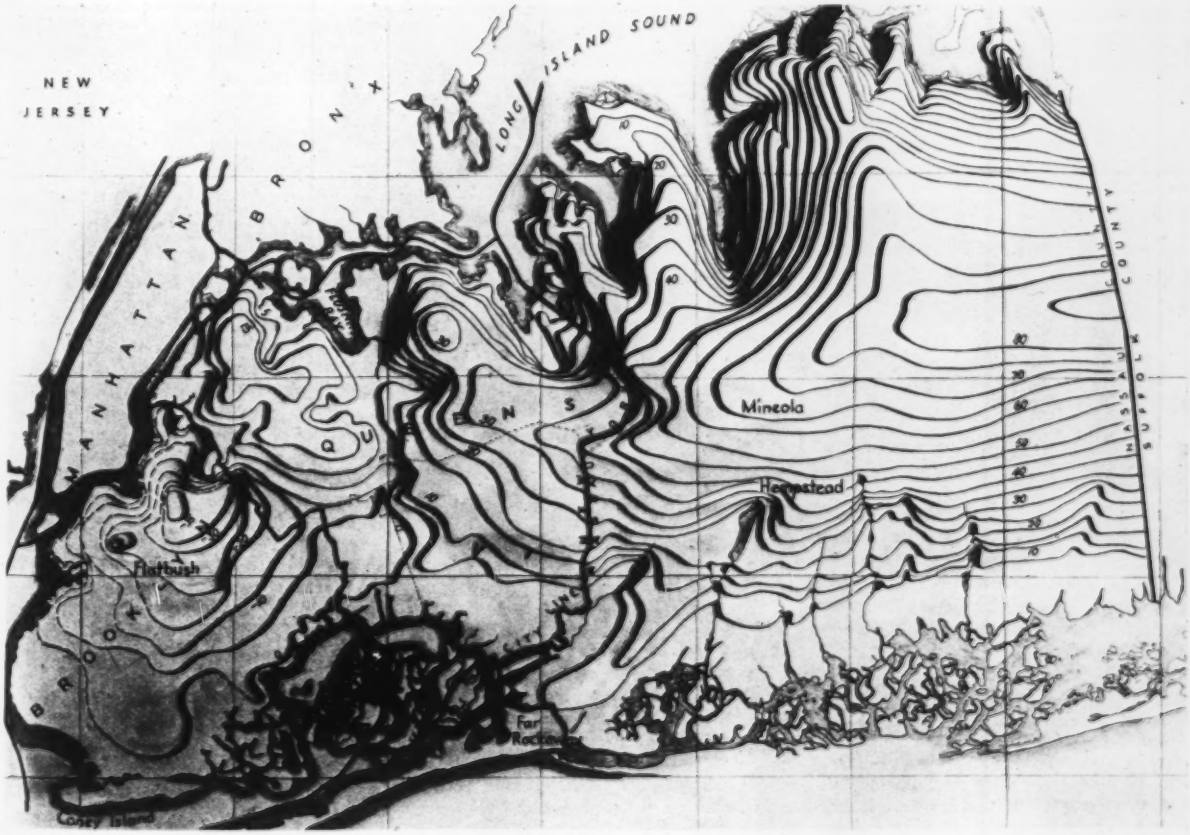


FIG. 2—BY 1933, as the upper map indicates, excessive pumping had pared down the groundwater hills seriously and formed huge depressions below sea level in Brooklyn and Queens; as the lower map shows, the results of new surveys in 1936 revealed a still more serious situation.

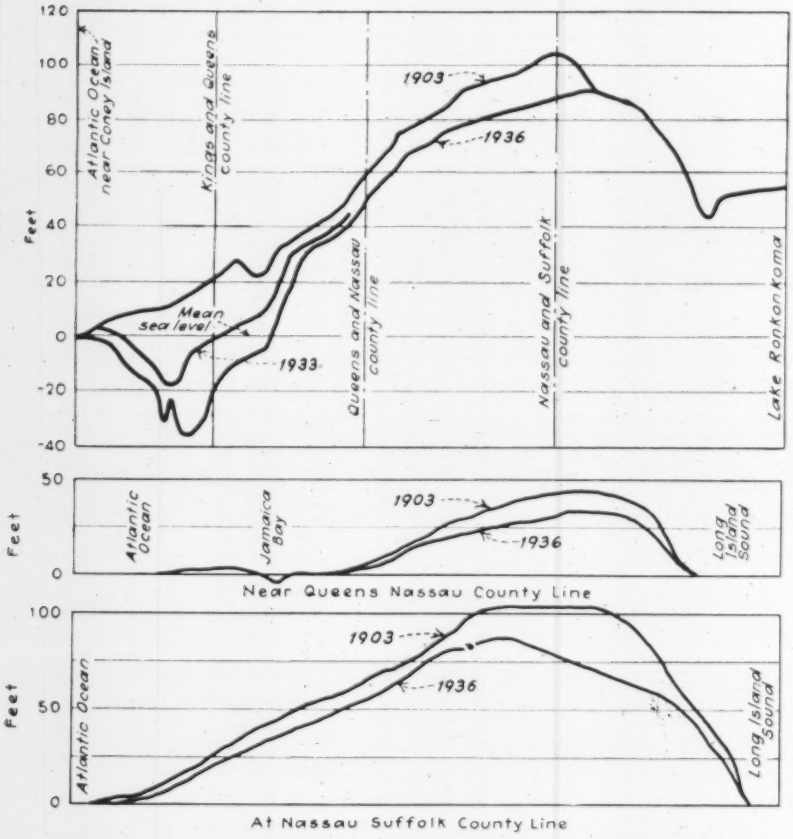


FIG. 4—WHAT OVER-PUMPING DID to the groundwater, as seen in longitudinal and cross sections.

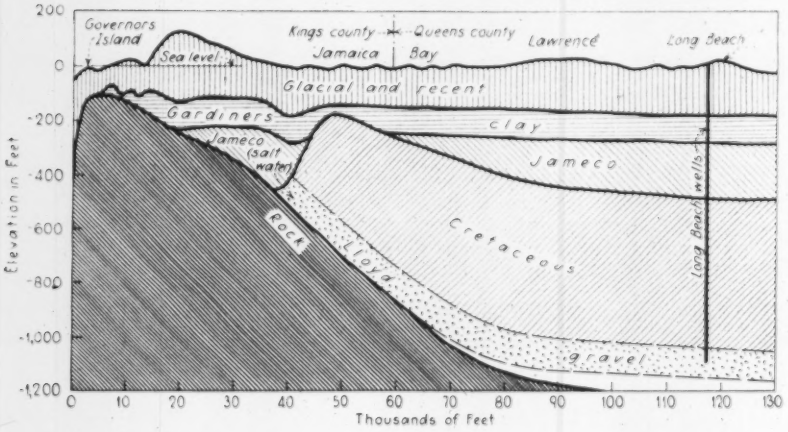


FIG. 5—THE BURIED "SOUND RIVER" in the Jamaica region threatens salting of the Long Beach source of supply.

for agricultural purposes, unless the commission has found that such wells will not injuriously affect public water supplies. (Public water supplies include those municipally and privately owned).

Under the first heading the commission has refused to approve of new wells for the supply of the people of the city of New York. Under the second it has withheld approval of most industrial wells in New York City except where the water is to be used solely for cooling, condensing and air-conditioning and is to be diffused back into the ground.

No power has been granted to the commission to stop pumping from existing wells, nor has it found itself to be justified in refusing to approve of new wells put down as true replacements of long existent wells which have deteriorated and are to be abandoned.

The powers of the commission have proved to be palliative rather than corrective.

These sources of water supply are of

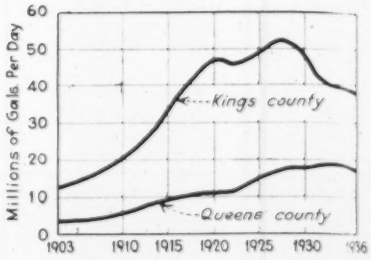


FIG. 6—IN THIRTY YEARS the industrial well draft has been tripled.

immense value to New York City and are essential to Nassau and Suffolk counties. To save them, effective control of the development of the groundwaters of the entire island is essential. This will be a new departure for the state of New York. It will require enabling legislation, reinterpretation of the law as to percolating waters, and the development of a special engineering technique.

Commission members

The Water Power and Control Commission is the head of a division of the Department of Conservation of the State of New York. The members are Lithgow Osborne, Conservation Commissioner, chairman, Frederick Stuart Greene, Superintendent of Public Works, and John J. Bennett, Jr., Attorney General.

Novel Transfer System For Overhead Cranes

FOR moving loaded overhead cranes from one bay to another in the new Detroit plant of the American Blower Corp., a novel transfer system has been designed through the cooperation of the engineers of the company and the consulting engineers, Albert Kahn, Inc. The two working bays, running the 364 ft. length of the building, are connected at either end by transverse bays 120 ft. long in which the transfer cranes operate. According to the Harnischfeger Corp., which supplied the cranes, the working bay units are of 5- and 10-ton capacity while the transfer cranes are of 25-ton capacity. Suspended from the bottom of each of the two transfer cranes is the end section of the working bay runway. When it is desired to move one of the working cranes from one bay to another it is run onto the transfer crane, which then moves along the end of the building into position at the end of the other bay. The working crane is then moved onto the working bay runway. Railroad tracks are located below the transfer cranes, which thus can be used to load or unload gondola car shipments.

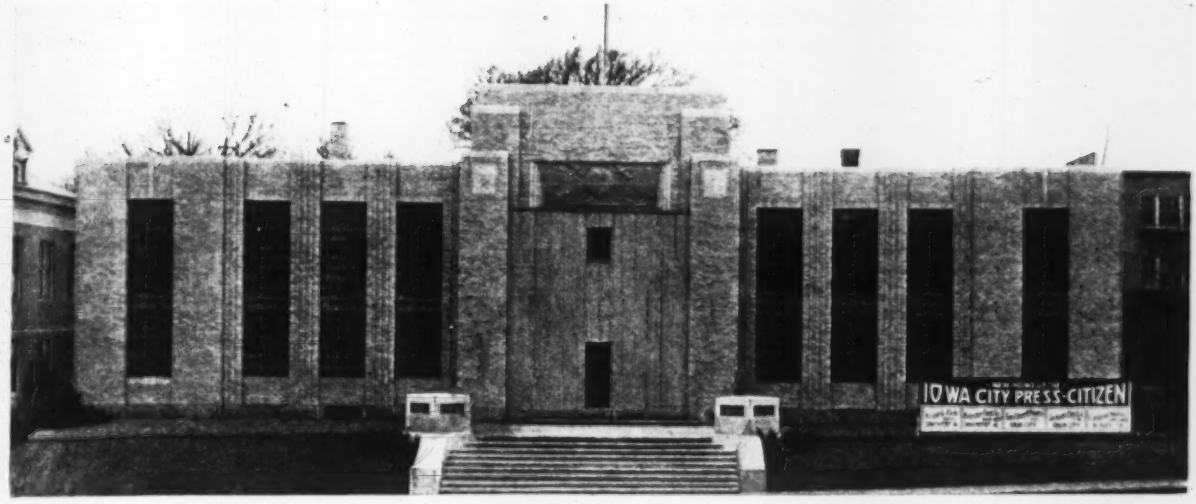


FIG. 1—WINDOWLESS but with 60 per cent of the wall filled with glass block, this newspaper plant is assured of good natural light.

Modern Building Design For a Small Town Newspaper

Large wall areas of glass block, summer and winter air conditioning served by a private well, acoustical insulation and glazed tile wall interiors are among features of Iowa City plant

A NEWSPAPER BUILDING incorporating air conditioning, indirect lighting and exterior walls built partly of glass blocks, and with no windows was recently completed at Iowa City, Ia. Built at a cost of $135,000 to house the editorial and production departments of the Iowa City *Press-Citizen*, it is considered one of the first structures for such a purpose to incorporate all these features.

The building is 112 ft. long and 76 ft. deep and faces the north. The front half is two stories high and houses the editorial, advertising and business offices. The south half is of one-story construction with the greater area occupied by a 90x90-ft. production room free of columns or other obstructions. It contains the linotype machines, the type-casting machines and the upper portion of a 24-pp. press which has its substructure in the basement.

About 60 per cent of the north wall, which includes the main entrance, is built of glass blocks, 12 in. square and 4 in. thick. One-half of the area of the other three walls is of similar construction. The sections constructed of glass blocks are 5 ft. wide and 18 ft. high in the front of the building, and 5 ft. wide and 12 ft. high in the side and rear walls. The blocks were placed with a thin galvanized metal strip imbedded in every other horizontal joint and with the joints between the glass blocks and the brick in the wall construction, being calked with oakum.

The main entrance has wide steps which are flanked on either side by a single, short pylon with a glass block section on the side nearest the building. Floodlights in the pylons illuminate the front of the building and the steps of the main entrance.

The interior of the building was designed to provide ideal working conditions. All of the rooms, except the receiving room in the basement, have been air-conditioned. Motor trucks may enter basement by a ramp at the back of the building for unloading paper, ink and other printing supplies.

The air-conditioning unit has been designed for automatic heating, and humidifying of the air during the winter and cooling and dehumidifying during the summer. The air is to be changed throughout the building every 20 min. and new air equal to 15 per cent of the total volume is added with each change. The fresh air will enter each room through ducts near the ceiling and leave through openings near the floor. Air from all toilets, a small kitchenette, the developing room, and the photo engraving room will not be recirculated.

Cold water for the cooling system is obtained from a privately-owned well at the rear of the building which is capable of supplying 150 g.p.m. The maximum cold water demand is estimated at 100 g.p.m. All pipes of the air-conditioning unit, as well as all hot and cold water pipes leading to the various parts of the building are of copper.

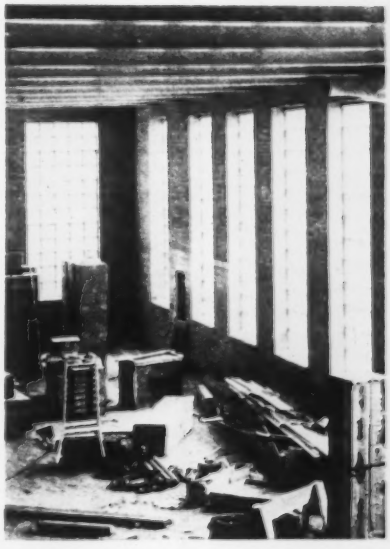


FIG. 2—INTERIOR VIEW of production room in new plant of Iowa City *Press-Citizen*.

A low-pressure steam boiler, heated by an automatically-controlled oil burner, supplies heat for the air-conditioning equipment. An underground tank provides storage for 12,000 gal. of fuel oil.

Silvered lamps for indirect lighting are being installed in the office section of the building and concealed cove lighting is used in the lobby. Direct lighting industrial units are to be used in the basement and production room.

Floors in the offices of the north portion of the building are covered with a resilient asphalt material. The concrete sub-floor of the production room is covered with wood blocks, with an intervening concrete filler in which are imbedded all pipes and conduits leading to the various machines.

The lower part of the interior wall surface in the greater part of the building is of glazed tile. Above the brick tile in the production room the walls are of smooth light brown brick. In the other rooms, the upper portion has been plastered. All door frames are steel flush with walls.

The ceilings in the two-story part of the building are covered with a 1½-in. layer of acoustical cork material. In the production department the space between the exposed I-beams supporting the roof has been filled with the same material. The roof consists of a 4-in. poured layer of gypsum covered by a filler-board insulation above which is a layer of tar and gravel. The roof is built without eaves.

The building was constructed by the Priester Construction Co., Davenport, Ia., with W. C. Covemaker, superintendent. Kruse and Klein, architects of Davenport, designed the building and its furnishings. John Winter was superintendent for the architects.

Tipton Sewerage System Modernized Under Federal Works Program

Beginning in 1933 under the CWA, the city of Tipton, Ind., has built two auxiliary sewers, an interceptor and a sewage disposal plant using CWA, FERA and PWA funds

By Lew Richards
City Engineer, Tipton, Ind.

BY CAPITALIZING fully on the opportunity presented by various national work relief programs, Tipton, Ind., has provided itself with a modern sewer system which has not only remedied the defects of the original system but which also makes provisions for anticipated future growth. The improvements consist principally of two new relief lines with a total length of more than 2 miles and a new intercepter sewer and disposal plant which has relieved the unsatisfactory and offensive conditions occasioned by the dumping of raw sewage in Cicero Creek which flows along the southern city limits. The old combination storm and sanitary sewer system that was in use in 1933 consisted mainly of three trunk lines; one of brick 30 in. in diameter for the eastern part of the city, another of the same diameter but of vitrified-clay for the southern central section of the city and the third, also of vitrified-clay 18 in. in diameter for the western section of the city. Because of flat grades, silting, clogging by tree roots and increased loads due to the expansion of the city, this system had time and again proved itself to be inadequate even in times of normal rains. Conditions were especially bad in the northwestern section of the city where streets and cellars were flooded and where after heavy rains the tracks of the Indiana Interurban R.R. were impassible and it was necessary to transfer passengers from the northern to the southern part of the city by motor bus.

In 1933 when CWA was inaugurated the city had been considering for some time the construction of relief sewers with a sufficient number of connections to the existing system to provide the necessary relief. CWA offered an immediate means of realizing these plans and at the same time providing worth while work for the city's unemployed; in consequence plans were made immediately to start construction on a sewer to relieve conditions caused by the inadequacy of the 30-in. brick trunkline serving the eastern part of the city. A preliminary survey for this line showed that to provide the necessary capacity, diameters of 36 and 30 in. would be required; that to maintain a satisfactory grade it would be necessary to place the sewer at depths ranging from 7 to 15 ft. Also that at this depth it would be necessary to place the sewer on quicksand for a considerable portion of its length.

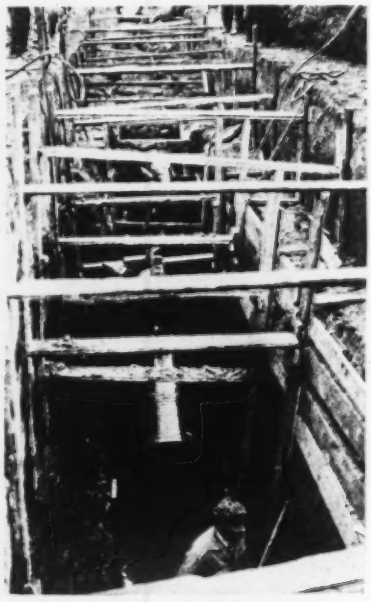


FIG. 1—TRENCHING for much of the sewer work had to be carried down into quicksand where it was found desirable only to open up short sections of trench to the full depth at one time and where partial backfill had to be done at once.

After carefully considering various materials with respect to their ability to meet the above conditions, corrugated iron pipe was chosen for the construction of this line. Factors which influenced this choice were the strength of this type of matrial to carry the fills that would come on it, also that its long sections, securely joined into one continuous length by special joints, would maintain its alignment in unstable soils without the use of cradling that would be necessary with the short sections of pipe. These factors, were of special significance considering the fact that the work had to be done in winter with unskilled labor.

Pipe coated with asphalt

In addition to its structural advantages this type of pipe has shown by its records elsewhere to have satisfactory durability. Its life expectancy can be substantially increased by a complete coating inside and out with specially prepared asphalt. For this reason the specifications for the pipe used at Tipton called for covering the inside bottom third with a smooth pavement of asphalt which would extend at least ⅛ in. above the crest of the pipe corrugations.

Construction was started at the outlet end at Cicero Creek. Only a sufficient amount of trench to accommodate the available number of workmen was opened at one time. Pipe was placed just as fast as the proper grade was reached. Backfill was tamped thoroughly around the pipe and for a short distance above the pipe. Where possible, an interval was allowed before complete backfill was made to allow the material immediately around the pipe to settle and become thoroughly compacted.

In a large number of cases, where the new sewer crossed existing lines, brick manholes were constructed to divert the flow from the old line to the new line. A sufficient number of such manholes were built to divert 75 per cent of the load of the old sewer to the new relief sewer.

Pipes jacked under railroad

One of the problems encountered in the construction of this line was that of placing the sewer under the Nickel Plate R.R. To avoid any interruption to traffic on the part of the railroad and to spare the city the expensive construction required for supporting the tracks should

open trenching be used, jacking was resorted to. When the jacking setup of lining timbers, backstop, etc. was made, it was intended to jack only the amount of pipe required to pass under the railroad. However, the progress made by this method was so satisfactory that it was decided to continue the jacking under East St., which parallels the railroad at this point. A total length of 84 ft. of 36-in. pipe, sufficient to carry the line under both the railroad and East St., was installed by this method. This made it unnecessary to cut the pavement and gave traffic the free use of the street at all times.

When CWA was superseded by FERA, the relief line for the eastern section of the city was completed. To remedy conditions in the western section of the city, the officials decided to install a second relief line, of the same material in diameters of 30 and 24 in. extending from an outlet in Cicero Creek a distance of 3,461 ft. to Walnut St. In the construction of this line the same procedure of construction and the practice of intercepting the old system at intervals, as described for the first line, was continued. Because of the previous success, jacking was again employed to install the line under State Route 28, an important state highway carrying heavy east and west traffic. The soil at that point was a water-bearing sand of an unstable nature, yet in spite of this unfavorable condition, 50 ft. of pipe was installed by jacking, making it unnecessary to cut the concrete pavement and detour the heavy traffic.

Vitrified tile pipe with precast asphalt joint fillers was used for the extremities of both relief lines, where smaller pipe diameters were called for. In these regions the soil was more stable and the depth of fill was not so great as near the outlets.

At one point in the northeastern part of the city where it was necessary to carry an 18-in. tile line under the tracks of the New York Central R.R. 50 ft. of 36-in. corrugated metal pipe was jacked through at the required line and grade and the tile line laid inside of it. Here again, the use of this method spared the railroad from issuing slow orders and the city the expense of supporting the tracks. Making the installation in this manner also protects the tile line from the impact of heavy railroad traffic.

Sewage disposal plant built

The consruction of the principal lines to give relief from the unsatisfactory conditions caused by overloading the old system was completed late in 1935. However, these lines still dumped raw sewage into Cicero Creek and did nothing to alleviate the unsatisfactory conditions arising from this practice. By 1935 these conditons had become so bad that farmers residing below the city filed a number of suits for damages against the city. To remedy this condition and to make the task of supplying the city with modern and adequate sewer facilities 100 per cent complete, the city officials applied for and were granted a PWA loan to defray the expense of constructing an intercepter sewer and a disposal plant.

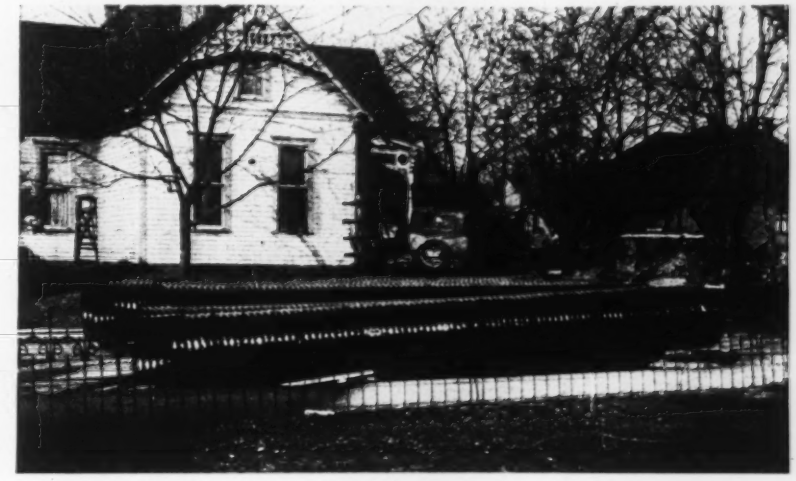


FIG. 2—CORRUGATED IRON PIPE in long lengths was used for the deep sections of sewer to facilitate maintaining the grade in soft ground.

The disposal plant is of the sludge digester type with both primary and secondary clarifiers, two trickling filter beds 95 ft. in diameter, pump house and drying beds. Ordinarily the plant reduces the organic matter 97 per cent. The intercepter sewer, which is 15 and 18 in. in diameter, is of vitrified clay with preformed asphalt joint construction. At seven points, where it intercepts lines originally discharging into Cicero Creek, concrete block manholes have been constructed with baffles which divert the normal flow into the intercepter. When the load on the sewer is increased by storm water, the excess flow in its highly diluted state flows into the creek. Shear gates are provided to divert all the flow from the intercepter should it be necessary to make repairs. Where the intercepter passes under the tracks of the Nickel Plate R.R. installation was again made first by jacking 96 ft. of 36 in. corrugated metal pipe under the tracks and then placing the tile line within the opening thus formed.

Other work undertaken

To date experience with the revamped sewer system has proved it to be an adequate and satisfactory answer to Tipton's sewer needs. By taking advantage of the opportunity of using relief labor the cost to the city has been limited to the money expended for materials and supervision. Incidentally, the financial conditon of the city was such that all materials were purchased on a cash basis. Tipton's civic progress has not been limited to the construction of the sewer, for, while sewer work has been in progress, the city has built and equipped a municipally-owned die-el-powered generating plant for providing power for an already municipally-owned distribution system. It has also developed a city park to a point where it is occupying an important place in the recreational life of the city. Present plans are to construct a swimming pool in the park during the summer of 1937.

The design and construction of the sewer was under the direction of the writer. Bevington-Williams, Inc., were consulting engineers for the disposal plant. The paved invert pipe, the material from which the larger of the relief sewers were constructed, was supplied by the W. Q. O'Neall Co. of Crawfordsville, Ind., who also supplied the equipment and supervision for the various jacking jobs. Ted McKinney, of Tipton, was the contactor for the construction of the disposal plant and the intercepter sewer.

Soap From Sewage

GREASE IN SEWAGE is now used in Germany in the manufacture of soap and for other industrial purposes, according to an item in the December issue of *Chemical and Metallurgical Engineering*. It is estimated that 80,000 metric tons of grease are allowed to flow into sewers in that country. The grease content is particularly high in waste water from restaurants and hotels, slaughter houses, butcher and sausage making shops. As the shortage of fats and oils in Germany is among the most acute of its national problems, they are hopeful of reclaiming 25,000 to 30,000 tons from this source for industrial uses.

Design of Street Structure In St. Paul, Minn.

Advanced paving, cross-section, drainage and curb and sidewalk practice developed in a $7,000,000 street modernization project

By Geo. M. Shepard
Chief Engineer, Department of Public Works, St. Paul, Minn.

IN THE LAST FEW YEARS St. Paul has spent about $7,000,000 in modernizing its streets. The amount and kind of improvement has of course varied but includes widening, repaving, surface-drainage structures, curbs and sidewalks. Design and construction have been kept up to advanced practice. In describing this practice it has been felt desirable to divide the account somewhat arbitrarily into two parts, the first part relating mostly to street structure other than roadway pavement proper, and the second part describing pavement bases and surfaces.

Width and crown

The roadway width is made to conform to the street width and traffic requirements. In the business districts with 60, 66 and 80-ft. streets, 40, 46 and 56-ft. roadways, respectively, are used. University Ave. has a maximum 95-ft. roadway on a 120-ft. street. A 5-in. crown is required on 30 and 32-ft. paved roadways in residential districts, a 6-in. crown on 36 and 40-ft. roadways without streetcar tracks, a 4-in. crown on 40-ft. roadways with streetcar tracks, a 7-in. crown on 56-ft. roadways without streetcar tracks and a 6-in. crown with streetcar tracks. On the 95-ft. roadway, with streetcar tracks, a crown of 9½ in. is used. The crown of the pavement conforms to a parabola except on wide roadways where a compound parabola is used. On wide roadways without streetcar lines, for drainage purposes, the crown of the center 20 ft. is a minimum of 1 in. and at the curb the slope of the crown is about 4 per cent for a width of 4 ft.; this results in a slight apex at the center but this is not noticeable and it eliminates water pockets.

The curb exposure in the downtown district on new work is normally 0.6 ft. and in the residential district is 0.5 ft., except for concrete pavement which has a curb 0.67 ft. high. On bridges as high as a 1-ft. curb exposure is used for safety under winter conditions. The minimum gutter grade is 0.4 per cent but should preferably be 0.5 per cent. Where the street grade is less than this the curb exposure is varied to obtain proper gutter grade.

The curb sections shown in Fig. 2 for plain and also for steel-protected radius curb are generally used. A steel plate for reinforcing and protecting the face of concrete radius curbs has been found easier to adjust and fully as satisfactory as special steel shapes or bent angles. On major street improvements in the business district an 8x24-in. concrete curb of section similar to Fig. 2b is used occasionally. In reconstruction where old granite or sandstone curb exists, and such old curb is in good condition, the old curb is reset.

The foundation for curbing is tamped and consolidated. The concrete mixture is 1 part portland cement to about 2 parts sand and 3 parts coarse aggregate of 1 in. maximum size, and contains not less than 1.57 bbl. of cement per cubic yard of concrete in place. (In this case as in the succeeding references to fine and coarse aggregate, in computing scale settings in the field all material retained on the No. 4 sieve contained in the fine aggregate as furnished, is considered as coarse aggregate, and all material passing the No. 4 sieve which is contained in the coarse aggregate as furnished, is considered as fine aggregate). An amount of water is used to give a concrete consistency that will enable the edging to be done and the top surface to be finished soon after pouring. While a steel trowel may be used, most of the concrete curb is finished with a wooden float so as to get a gritty rather than a glossy finish.

Concrete curbing is divided into sections 5 or 6 ft. long by metal plates ¼ in. thick extending throughout the cross-section of the curb; these plates are set before the concrete is poured and not removed until the concrete has set sufficiently to maintain an open joint. Removing the plates is facilitated by tapping and loosening soon after the concrete has taken initial set. Expansion joints ½ in. thick are required at intervals not exceeding 50 ft. and at the ends of all radii. The joint is formed by placing pre-molded expansion-joint material in the form before concrete is poured. An expansion opening 1 in. wide is left wherever concrete or tile sidewalks abut the curb; these joints are later filled with as-

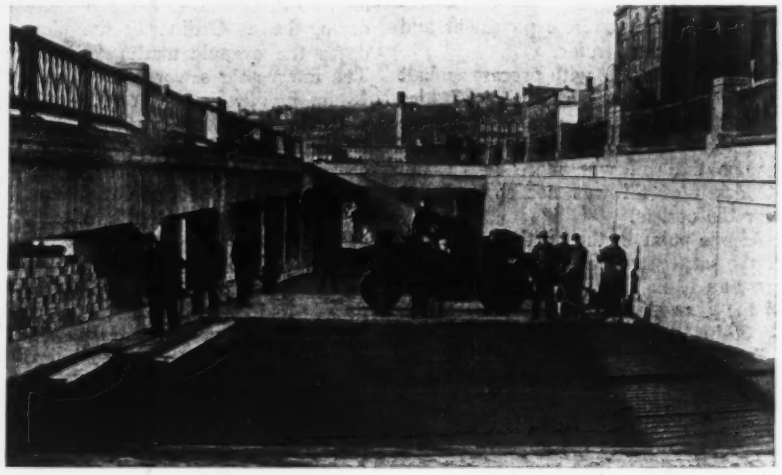


FIG. 1—BRICK PAVING is common on steep grades in St. Paul; paving in progress on 6½ per cent grade of Kellogg Boulevard ramp.

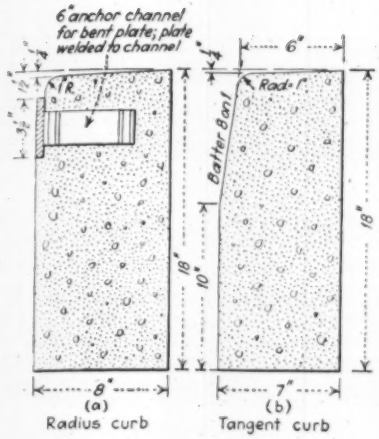


FIG. 2—STANDARD SECTIONS for new concrete curbs in St. Paul street modernization.

phalt joint filler the full depth of the abutting sidewalk. Either metal or wood forms may be used but at present practically all concrete curbing is laid with metal forms. The curb as soon as finished is covered with burlap which is kept wet and left in place for at least 24 hr. The use of ready-mixed concrete as well as concrete mixed on the site is permitted for curbing.

Sidewalk construction

All new sidewalks are of one-course concrete, but a large proportion of the sidewalks in the city are still of cement-tile construction, both 18-in. and 24-in. square cement tile 2 in. thick, having been in use for many years. In repair work where over 50 per cent of a tile walk requires renewal, new monolithic one-course walk is ordered in. The concrete for monolithic sidewalks is 1 part portland cement and 5 parts aggregate, about 2 parts of which are fine aggregate and 3 parts are coarse aggregate of 1-in. maximum size. The materials are mixed according to approved methods and deposited on a compacted subgrade.

Monolithic sidewalks are 4 in. thick in residential districts, 5 in. thick in business districts and 6 in. thick for driveways. The concrete as placed is tamped and struck off with a template; the surface is then floated with a wood float until it has a true surface, care being taken not to bring an excess of water to the surface and to leave a gritty final finish. The walk is cut through to the subgrade into separate rectangular slabs not larger than 6 ft. on any side and the surface edges of each slab are finished to a ¼-in. radius. Expansion joints 1 in. thick are required where sidewalks abut the curb, buildings or intersecting sidewalks. Traverse expansion joints ¾ in. thick are formed across the walk at intervals not exceeding 50 ft.; these extend through the entire thickness of the walk and are filled with asphalt joint filler.

Inlets and catchbasins of the types shown in Fig. 3 are used on paved streets with such modifications as are

FIG. 3—DRAINAGE structures used in street modernization in St. Paul; the several forms are used at different points as indicated by the intersection plan.

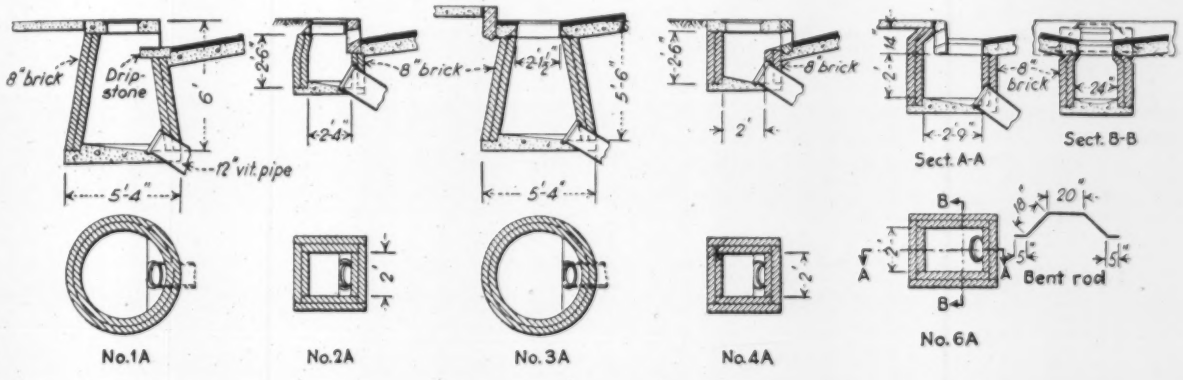
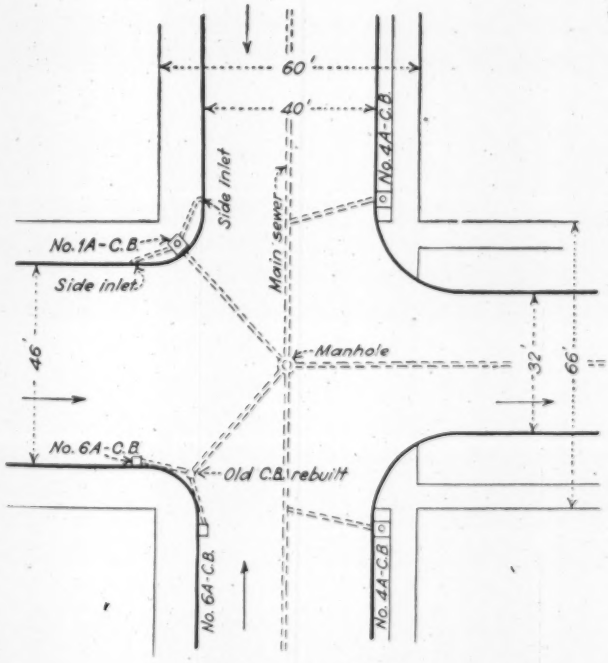
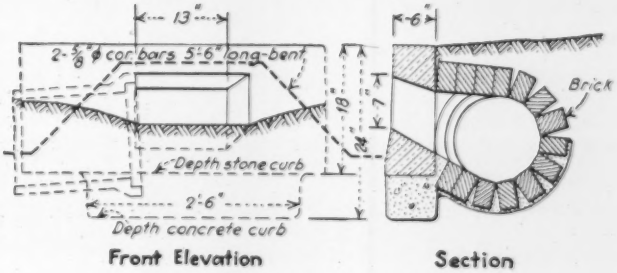
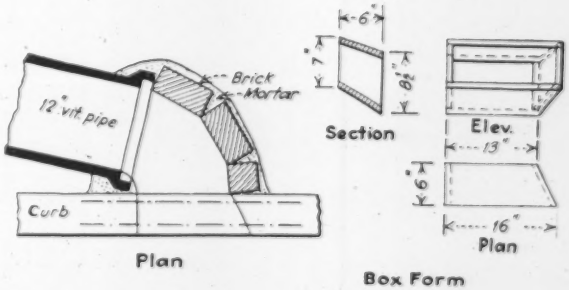


Fig. 3







required for special conditions. Where necessary to accommodate larger than normal quantities of water the length of curb opening to catchbasins or inlets is increased, and the top portion of the curb is especially reinforced over the opening. A minimum size of 12 in. sewer connection is required from catchbasins or inlets.

Alley pavements

The greater portion of alley pavement is one-course concrete without reinforcement, although a few alleys have in the past been paved with other materials. The section used is a dished section with the edges about 0.3 ft. higher than the center, the center of the alley serving as a drainage water course. No attempt is made to control cracking in concrete alley pavements. Due to the difficulties in maintaining the dirt surface on unpaved alleys in the spring of the year the department of public works has recently required that all alley grading improvements shall include a 2-in. bituminous surfacing except where concrete paving is ordered. This has greatly reduced the maintenance costs, particularly on grade and has provided general satisfaction at comparatively low cost. Following the grading the alley surface is scarified and about 0.5 gal. per sq.yd. of road oil is applied and mixed by a blade. This stabilized subgrade is then rolled and the asphaltic surfacing, a plant mix of the following proportions, is placed and rolled so as to give an addition 2 in. of surfacing on the prepared subgrade:

	Per Cent by Weight
Paving asphalt 60 to 70 penetration	3½ to 4½
Road oil No. 3	1 to 1½
Sand—2 parts fine asphalt sand 1 part coarse asphalt sand	45 to 57
Buckshot gravel ⅜ in. maximum	43 to 50

Pavement types

The total mileage of pavement in St. Paul on streets and bridges laid progressively since 1882 is shown by Fig. 4. The upper line indicates the total cumulative mileage of pavement since that date and the lower line the amount of pavement actually in place, the difference being replacements. Much of the early replacements as shown on this chart were of the old cedar-block pavements on plank foundations and granite block or cobble stone laid on sand. Where an asphaltic surface has replaced a creosoted-block pavement on the original base, it has not been considered a replacement. Of the present total area of 6,122,000 sq.yd. of pavement in the city about one-half is of asphaltic types and the balance is concrete, brick, creosoted blocks, granite block and sandstone block. One-course reinforced-concrete pavement was first laid in 1912. Asphaltic concrete of the Topeka-mix type was first laid in 1914 as a 2-in. wearing surface on a 5 or 6-in. concrete base. Natural cement base was used until about 1906 on all pavements. So much for the historical record.

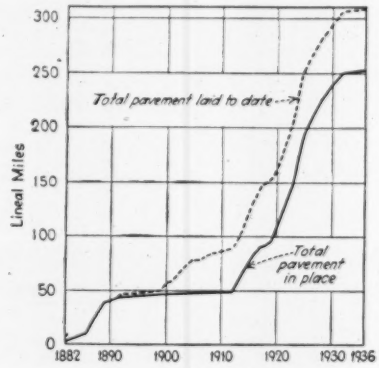


FIG. 4—CUMULATIVE MILEAGE of street paving constructed in St. Paul since 1882.

The present practice generally is to use an asphaltic-concrete pavement in the business district and where possible on heavy-traffic connecting streets; these pavements have a 2-in. asphaltic-concrete wearing surface with 1½-in. binder on a 7-in. plain-concrete base. For outlying districts or residential streets a 2-in. asphaltic-concrete wearing surface on a 6-in. plain-concrete base is used or a 7-in. one-course reinforced-concrete pavement.

Experience has shown that while this type of asphaltic-concrete generally cracks at about 40 or 50-ft. intervals in winter, it is not subject to the irregular cracking so prevalent in this climate in sheet-asphalt. Also cracks in the asphaltic-concrete are not troublesome and when cleaned out and filled for two successive seasons with joint filler, require little further attention. With a seal coat and stone-chip dressing this pavement has a relatively non-skid surface. It has also the advantage of all asphalt types, easy repair of cuts in the street.

Where asphaltic-concrete or sheet-asphalt is laid in areas requiring continuous parking of vehicles along the curb a parking strip 7 ft. wide of 2½-in. brick, laid flat, is provided. Brick is also used to a considerable extent on heavy-traffic streets where grades exceed 4 per cent and on narrow business streets with street car lines, 3-in. brick being laid between the outside rails and the curb. The street-railway company is required under its franchise to pave between the tracks and rails and for a distance of 2 ft. outside of the outer rails with the same material as the balance of the street. This requirement is modified however to permit the use of granite blocks in the heavy-traffic business areas and one-course concrete in the outlying areas. Where the street is paved with asphalt, and concrete or granite blocks are used between the rails, two rows of granite blocks or three rows of brick are laid longitudinally outside of the outside rails to permit repairs to the rails without disturbing the asphalt surface.

Particular attention is given to obtain a true surface and contour for the concrete base of these pavements as well as for the wearing surface. This is obtained, as will be described in a subsequent article, by laying the base in strips and by accurate control at intersections.

St. Paul has just completed a $7,000,000 program of street widening and improvement mainly in the business district and on arterial streets in which these types of pavement have been used. Paving work is generally done by contract although an estimate is submitted by the chief engineer of the department of public works when bids are opened, and the commissioner of public works is authorized under the charter to proceed with such work by day-labor when so ordered by the city council. Abutting property is assessed the full cost of curb and sidewalk and a maximum amount equivalent to the cost of paving a 12-ft. strip. The balance of the cost of paving improvements such as drainage, intersections and the street width not assessed to the property is paid either from a special bond fund or from a budget fund set up for this purpose.

Making Soft Bottom Soundings

IN DREDGING work connected with reclamation of shoals in San Francisco Bay on which the Golden Gate International Exposition will be built, many preliminary soundings had to be made where portions of the bottom consisted of extremely soft material. The method of determining depth was to attach a 6-in. metal disk to the bottom of an 8-lb. sounding lead such as is used ordinarily in marine navigation. A weight so equipped would sink some distance into the extremely soft mud but the results were comparable over the entire area and were regarded as giving more uniform results than would have been obtained with the ordinary sounding lead without the disk.

Depths so obtained had to be compared with soundings made at earlier dates by other methods; in some cases by the ordinary sounding lead without any attachment, and in some cases by a sounding lead with a disk of larger diameter attached. Differences amounting to several feet were noted between readings with the sounding lead (minus disk) and with the lead equipped with a 6-in. disk.

Wear on Sheepsfoot Rollers Decreased by Revised Design

Roller feet used in compacting rock of San Gabriel Dam No. 1 ordinarily serve 1,200 hours before replacement—Special steel used—Feet shaped to permit roller movement in either direction

By Paul Baumann
Junior Asst. Chief Engineer
Los Angeles County Flood Control District

SATISFACTORY performance has marked the use of sheepsfoot rollers of special design developed for compacting the earth- and rock-fill which is being placed by the Los Angeles County Flood Control District to form San Gabriel Dam No. 1. Wear on the feet has been such that renewals were required only after periods of 3 to 5 months of operation, thus justifying the confidence placed in the special foot design worked out for this job, described in *Engineering News-Record*, June 11, 1936, p. 835.

Experience in operation of the rollers is reflected by data in the accompanying tables which divide the work into two classes. The major part of the yardage goes into Zone 3, which contains quarry-run rock that has passed through 6x9-in. grizzly openings. A smaller quantity of material used as a facing on the dam, classed as Zone 2, consists of a clayey sand.

In the rollers as originally put in service the design of the feet was very carefully proportioned (as described in the article mentioned) according to a theory that made them heavier and in shape somewhat different from the conventional design. However, a feature in common with the conventional design was the fact that the feet had toe and heel ends. In other words, the design was based on the assumption that the rollers always would move forward except when backing in the process of making turns.

In the course of operation on San Gabriel Dam No. 1 it was found more advantageous to operate backward and forward rather than in one direction only. Two-way operation made it possible to follow dumping and spreading operations more promptly and the advantage was sufficient to justify changing the roller operation program accordingly. Because of reversal in direction of travel, when the time came for replacing worn feet it was decided to use a symmetrical design. At the same time Meehanite was substituted for the cast-steel previously used. The first replacement of cast-steel feet was made March 10, 1936; comparative data on service given by the two metals are recorded in the accompanying tables.

Five rollers of identical design were in use on the dam between Nov. 27, 1935, and April 4, 1936; four assigned to Zone 3 and one to Zone 2. These rollers have been in operation more or less continuously since they went on the job and the average working time up to the end of 1936 was about 3,300 hours for each of the rollers. During this period renewal of the feet was required on an average every 1,200 hours. The rollers were reheaded as often as the area of the feet was reduced by 30 per cent.

Comparison of the tabulated data indicates an increase in the average cubic yard per roller resultant from changes in the shape of the feet and the material used. This increase is about 22 per cent for Zone 3 and about 28 per cent for Zone 2. The cost of cast-steel feet, delivered to the job, was $1.17 each; the redesigned feet using the new material cost 78½c. delivered.

In making the revisions in design allowance was made for wear. The area of new feet now is 15 per cent greater than the average bearing area and the feet are to be replaced when the original bearing area has been decreased by wear by about 30 per cent. In this reduction of area the original weight of the foot is decreased by about 40 per cent.

The more symmetrical wear on the feet of the later design is believed to be due mainly to the change in shape. When feet with heel and toe were operated backward there was relatively rapid wear on the heel. Feet of latest design are heat-treated; the bearing surface is hardened by quenching to a Brinell rating of 500 to 550.

In Table II it may be noted that the life of the feet decreased in Zone 3 toward the end of the year 1936. This is ascribed to working with harder rock containing less fines, which necessitated additional passes to break down the fragments, produce fines and attain the desired compaction. In considering the amount of service rendered, i.e., the wearing qualities, the number of hours of service alone does not tell the whole story. Rather, the total yardage of material rolled as reflected by the average cubic yards per hour is the true index of durability (provided, of course, the material compacted is substantially the same). As this job has progressed the fill material used in Zone 3 has increased in hardness and in the size of fragments, hence subjecting rollers to heavier requirements.

TABLE I — RECORDS OF WEAR ON CAST-STEEL FEET

Roller No.	Zone	Date Started	Date Re-headed	Hours in Service	Cu. Yd. Rolled (zone total)	Cu. Yd. Per Hr. (zone aver.)
4	3	11-27-35	3-10-36	1,352	645,820	122
6	3	12- 9-35	3-14-36	1,216		
7	3	12- 9-35	4-17-36	1,458		
9	3	4- 4-36	7- 6-36	1,278		
Total				5,504		
8	2	1-22-36	5-12-36	1,104	163,889	148

TABLE II — RECORDS OF WEAR ON MEEHANITE FEET

Roller No.	Zone	Date Started	Date Re-headed	Hours in Service	Cu. Yd. Rolled (zone total)	Cu. Yd. Per Hr. (zone aver.)
4	3	3-10-36	7- 9-36	1,144	805,065	149
6	3	3-14-36	8-28-36	1,424		
7	3	4-17-36	8-31-36	1,152		
			12-21-36	854		
9	3	7- 6-36	10- 6-36	816		
Total				5,390		
8	2	5-12-36	9-18-36	1,200	288,250	190

Building Officials Invite Joint Sessions

THE Building Officials Conference of America has announced that its 1937 national convention will be held at Cleveland, Ohio, the Hotel Hollander, May 31-June 4 inclusive. The Mayor of Cleveland is proclaiming the week of May 31 Builders Week, and the Great Lakes Exposition is designated Thursday, June 3, as Builders Day at the Exposition.

The Building Officials Conference has issued invitations inviting organizations connected with the construction industry to arrange to hold concurrent meetings in Cleveland. Among the groups invited are associations of architects, engineers, contractors and builders, as well as affiliated organizations of building officials throughout the country. A number of such organizations have already made plans for assemblies, and others are taking steps towards such action.

It is planned to hold one or more joint meetings of such allied groups during the convention to take up items of mutual interest. The convention committees state that they are still open to suggestion on possible subjects for such joint meetings.

Measuring Soil Moisture

Tests by Bureau of Reclamation bring out new facts on effects of compaction, temperature, grading and composition of the soil

By D. O. Ehrenburg
U. S. Bureau of Reclamation
Denver, Colo.

THE DETERMINATION of moisture in sand by electric-resistance measurements was first described by Chas. E. Wuerpel (*Engineering News-Record*, July 11, 1935). The method is based upon the principle that moist sand (or soil) is an electrolytic conductor and its ability to carry an electric current depends upon its moisture content.

During the winter of 1935–36 the U. S. Bureau of Reclamation laboratories in Denver constructed a portable electric instrument to determine the moisture content of sand and soil. This instrument, called a moisture-meter, was investigated for two purposes: (1) control of the moisture content of soil in earth-dam construction and (2) determination of the moisture content of sand for use in concrete.

The moisture-meter was used to control the moisture content of soil in an extensive series of large-scale compaction tests. A compaction machine simulating the effect of a sheepsfoot roller was constructed, and Platte River soil was compacted under variable conditions of pressure and moisture content. About twenty 150-lb. soil samples of given moisture content had to be prepared daily. The moisture control was carried out entirely by electric measurements and the results were found to be entirely satisfactory in accuracy and speed.

The moisture-meter is shown by Fig. 1. The sample is compacted in the cylinder, by dropping the cylinder four times in its wooden frame. No leveling-off is required after compacting the sample, since the excess material (above the upper electrode) has no effect whatever upon the electric circuit, as shown by Fig. 2. The electrodes, of which the upper is a metal ring and the lower is the metal base of the cylinder, are also shown by Fig. 2. The electric meter box contains two 45-volt B-batteries, an ammeter with shunts, a voltmeter, a rheostat and a push-button switch. The circuit diagram is shown in Fig. 2.

The moisture determination is made by measuring the temperature of the material and the current flowing through a compacted sample when the voltage is adjusted to 80 volts. Having the current and the temperature, the operator finds the moisture content from a calibration chart. The calibration chart for the Platte River soil is shown by Fig. 3; each material requires a separate calibration, as pointed out by Mr. Wuerpel.

The moisture-meter is calibrated by preparing a number of samples at regular moisture-content intervals; measuring the current flowing through each compacted sample at 80 volts; measuring the temperature of each sample and determining the moisture content of each sample by evaporation in a drying oven at 210 deg. F. The calibration curve for any one temperature being available, a curve for any other temperature may be calculated by a simple slide-rule operation, as explained later.

The conductivity of soil depends upon its moisture content, and also upon (1) the degree of compaction of the soil; (2) the temperature of the soil; (3) the composition and grading of the soil, and (4) the nature of the water (dissolved salts).

The degree of compaction is accounted for by compacting the sample according to a standard procedure (dropping it a given number of times from a specified height); the effect of temperature, is accounted for by measuring the temperature of the sample and applying a correction factor; the effect of composition and grading is accounted for (in the laboratory) by using a thoroughly mixed, homogeneous material, and the variation of the salt content of the water is of little or no importance as long as clean tap water is used. The effect of water was fully discussed by Mr. Wuerpel and need not be taken up here.

Compaction—Electric measurements of uncompacted samples are generally erratic. The more compaction the sample is given, the more consistent are the results. The conductivity of a sample increases with, but much more rapidly

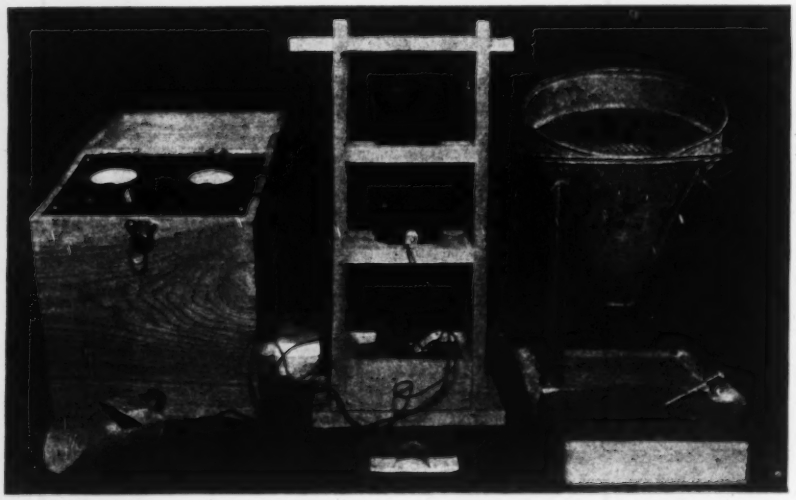


FIG. 1—MOISTURE METER and accessories for the electric determination of the moisture content of soil.

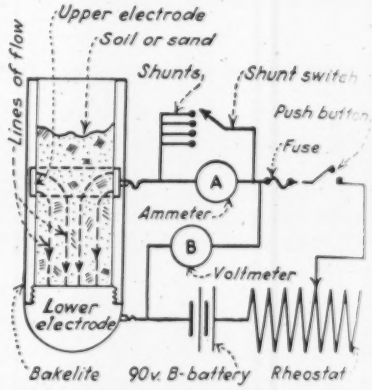


FIG. 2—ELECTRIC CIRCUIT of the moisture meter shown diagramatically.

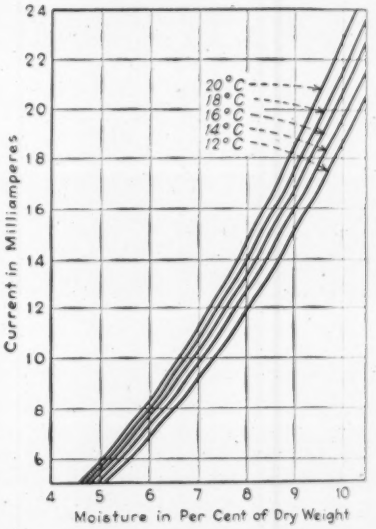


FIG. 3—CALIBRATION CURVES for Platte River material; each material requires a separate calibration.

than the density. In one case, an increase of 17 per cent in density gave an increase of 52 per cent in conductivity, as shown by Fig. 4.

Temperature—The ability of moist soil (or sand) to conduct electricity is due to the water that it contains. The ability of water to conduct electricity is, in turn, due to the charged particles (ions) of the salts that are dissolved in the water. The conductivity of a salt solution increases with rising temperature and the law governing this increase is the same for all salts.

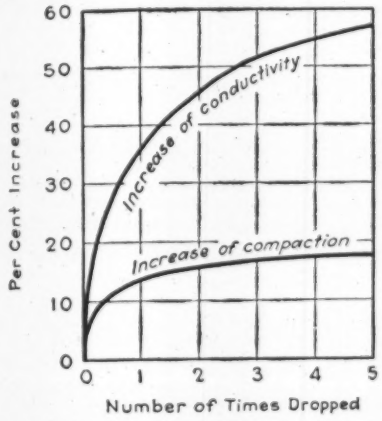


FIG. 4—CONDUCTIVITY varies with degree of compaction; the curves are for wet sand compacted by dropping the cylinder a varying number of times.

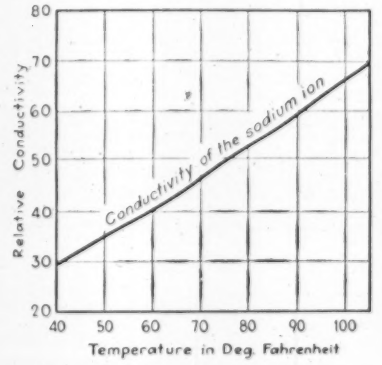


FIG. 5—EFFECT of temperature on conductivity as indicated by the conductivity-temperature curve of sodium ion.

The temperature variation of the conductivity of the sodium ion (positively-charged particle of sodium chloride) is given in Fig. 5. In the interval from 40 deg. F. to 90 deg. F. the curve in Fig. 5 may be represented by the following equation:

$$y = 12.196 + 0.367x + 0.00176x^2$$

where x is the temperature in degrees Fahrenheit, and y is relative conductivity.

Suppose that a moisture sample at 52 deg. F. carries a current of 10.0 milliamperes at 80 volts; required, the current which the same sample would carry at 58 deg. F., at the same voltage. Denote the values of y at 52 deg. and at 58 deg. by y' and y'', respectively. Then, the value of 10.0 m.a. is to be multiplied by the factor y''/y'. In practice, values of y''/y' are computed at one-degree intervals and arranged in a double-entry table. (See accompanying sample.) In the numerical example given above, enter the column marked 52 and the row marked 58. At the intersection of the column and the row find the factor 1.094; multiply 10.0 m.a. by 1.094 and obtain 10.9 m.a., which is the current at 58 deg. F.

A Portion of the Temperature Correction Table

Temperature, Deg. F.

Temperature, Deg. F. (FROM \ TO)	50	51	52	53	54	55
50	1.000	0.985	0.970	0.956	0.941	0.928
51	1.016	1.000	0.985	0.970	0.956	0.942
52	1.032	1.016	1.000	0.985	0.970	0.956
53	1.047	1.032	1.016	1.000	0.985	0.971
54	1.063	1.047	1.032	1.016	1.000	0.985
55	1.079	1.063	1.048	1.031	1.015	1.000
56	1.095	1.078	1.063	1.046	1.030	1.015
57	1.111	1.094	1.078	1.062	1.045	1.030
58	1.127	1.110	1.094	1.077	1.060	1.045
59	1.144	1.126	1.110	1.093	1.076	1.060

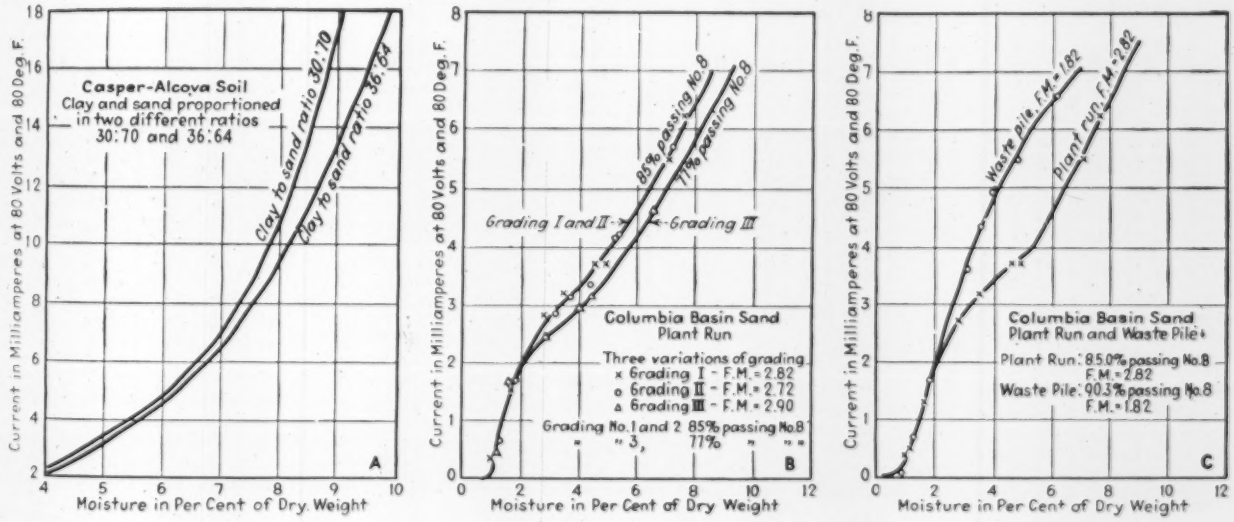
To verify the validity of the temperature-correction formula, calibration curves covering the range from 54 deg. F. to 68 deg. F. were calculated from calibration data obtained at 40 deg. F. These curves were used for determining the moisture content of about 600 samples, and the moisture content of over 200 of these samples was checked by evaporation. It was found that on the whole the electrical method and the evaporation method agreed within 0.2 per cent with occasional variations up to 0.5 per cent.

Composition and Grading—The effect of composition and grading on the conductivity of soil limits the employment of the moisture-meter to the laboratory, where the material dealt with can be made homogeneous by thorough mixing. Fig. 6A shows what can happen to the conductivity of an actual earth-dam material, composed of sand and clay, if the proportioning is permitted to vary slightly.

Discussing the possibilities of the electrical method for sand moisture determinations, Mr. Wuerpel expressed the belief "that differences in gradation will offer no serious difficulties in this method," as long as these differences are not excessive. From the results of Fig. 6B, however, it is apparent that even small differences in grading may materially alter the conductivity of sand.

In a borrow pit, the material will ordinarily vary from point to point not only in grading but also in composition. The term composition covers the shape and mineralogical make-up of the particles, the soluble-salt content of the soil and the dissolved-salt content of the

FIG. 6—TEST CURVES from various soils showing effect of grading on degree of conductivity.


Current in Milliamperes at 80 Volts and 80 Deg. F.
Casper-Alcova Soil
Clay and sand proportioned in two different ratios 30:70 and 36:64
Clay to sand ratio 30:70
Clay to sand ratio 36:64
A
Moisture in Per Cent of Dry Weight
85% passing No.8
71% passing No.8
Grading I and II
Grading III
Columbia Basin Sand
Plant Run
Three variations of grading
x Grading I - F.M. = 2.82
o Grading II - F.M. = 2.72
Δ Grading III - F.M. = 2.90
Grading No. 1 and 2 85% passing No.8
" " 3, 71% " " "
B
Moisture in Per Cent of Dry Weight
Waste pile, F.M. = 1.82
Plant run, F.M. = 2.82
Columbia Basin Sand
Plant Run and Waste Pile
Plant Run: 85.0% passing No.8 F.M. = 2.82
Waste Pile: 90.3% passing No.8 F.M. = 1.82
C
Moisture in Per Cent of Dry Weight

water contained in the soil. Of these factors, the soluble-salt content of the soil is generally the most variable and, therefore, the most important.

Tests made on field samples taken from the same borrow pit have shown that two samples which are almost identical in grading may yield calibration curves which neither coincide, nor fan out regularly in the manner of the curves in Fig. 6A. Large, erratic differences between the calibration curves of two samples of about the same grading must be ascribed to differences in the composition of the soil.

In order that the moisture-meter may be successfully employed, the material on which determinations are to be made must be homogeneous, that is, it must be uniform in composition and grading, uniform in the distribution of the moisture content and free from lumps. All these conditions can be easily satisfied in the soils laboratory, but cannot be satisfied at the borrow pit or stock pile.

Conclusions

1. The moisture-meter offers a quick and accurate method for determining the moisture content of soil or sand, provided the material is uniform in composition and grading. The instrument has a place in the soils laboratory and was successfully employed in large-scale earth compaction tests.

2. The effect of grading upon the conductivity of sand is considerably greater than it was believed to be by pioneer investigators. The only way to minimize errors due to variations of sand grading (under field conditions) is to employ larger, more representative samples. In the method described by Mr. Wuerpel the conductivity of sand is measured directly in the mixer storage bin. The accuracy of this method depends upon how constant the sand grading remains from day to day. At the Grand Coulee Dam mixing plant a circuit similar to that used by Mr. Wuerpel has been recently installed at the sand batching bin for the purpose of indicating, rather than accurately measuring, the variations from batch to batch of the moisture of the sand.

3. The temperature-correction system described makes it unnecessary to calibrate the apparatus at several different temperatures, as earlier operators did. Calibrating has thus become simpler and speedier, and the method as a whole has been rendered more accurate.

Thin Concrete Bridge Floor Wears But Little in 10 Years

By George W. Buck
County Engineer, Multnomah County, Ore.

THE BURNSIDE BRIDGE across the Willamette River in Portland, Ore., is one of the half dozen bridges that link the west side of the city, in which the principal business district is located, with the manufacturing and residential sections east of the river. All these bridges carry extremely heavy traffic including the wheel concentrations which go with trucking in large cities. Because of its location, the Burnside Bridge carries a generous share of the traffic; a present daily average of 37,000 passenger cars and 5,100 trucks.

This structure, opened to traffic in July, 1926, has a bascule main span whose 68 ft. roadway is paved with reinforced concrete. Because of load that would be imposed upon the bascule operating mechanism it was desirable to keep the weight of the floor slab and therefore the slab thickness to a minimum. To this requirement is ascribed the unusual and perhaps unique characteristic of a floor slab only 4¾ in. thick, used throughout the entire roadway area in panels as large as 5 ft. by 5 ft. 8 in. The slab was laid with two-way reinforcement, a very rich concrete mix (1:1:2), and working stresses of 975 lb. per sq. in. under 20-ton trucks having 70 per cent of the load on the rear axle. Nothing was said in the specifications regarding allowance for impact.

BURNSIDE BRIDGE (below) crosses the Williamette near the business district and carries a generous share of traffic to East Portland. Surface wear (right) of slight depth is the only trace left by 10 years of traffic over this Portland bridge roadway. Reinforcing bars displaced upward took their share of the wear.

This concrete deck, which now has had 10 years of extremely heavy service, recently was examined by the writer. It has not been subjected to a great deal of abrasion by tire chains, for Portland winters are mild and chains are required only occasionally, perhaps for a total of two or three weeks during an entire winter. Otherwise the traffic is such as would be expected in any large city.

In observing the condition of the roadway today, probably the most notable feature to record is that the surface is in substantially the same condition that it was when the bridge was built. Very little change has occurred. Whatever may have been the maximum wheel loads that have come upon it the slab has had adequate structural strength to carry its load without distress of any sort. The following observations, none of them indicating any serious defects, were noted:

In some areas of considerable extent the surface itself has been worn or abraded, taking off the thin surface film of cement base and exposing the aggregate beneath, there appears to be little or no wear of the aggregate. Such a condition is illustrated in the photograph reproduced above.

Shrinkage cracks were rather numerous as the natural result of the rich mix used. These developed, in general, transverse to the roadway but bear

no particular relationship to the steel supporting framing below. The cracks are fine, are characteristically irregular in their course, and are entirely free from chipping or breaking down along their top edges.

Quite numerous small pockets once occupied by clay balls or bits of wood appear on the surface here and there. Ends or sections of several reinforcing bars, bent and sprung to the surface of the concrete, are to be seen in a number of places. Where steel is so exposed it shows characteristic wear from traffic, as is the case with the concrete.

Aside from changes of the three kinds noted the roadway gives no indication of wear and remains the same as it was when put in service.

The bridge was designed by Hedrick and Kremers; the late Gustav Lindenstal was consulting engineer.

Cantilever Floor Saves One Line of Columns

Two-story factory in Cincinnati, 50 ft. wide, is framed with two-column bays, concrete in the first story and steel in the second

GIVEN a space 50 ft. wide to be framed for a building, conventional practice would place a line of columns in each wall and another on the centerline, providing two 25 ft. bays. In a new 50x200-ft. two-story factory for the Edwards Mfg. Co. in Cincinnati, the engineers discarded such precedent and used only two rows of columns, set in 12½ ft. from each wall. The result is a significant framing innovation and, since the end columns are also set back 12½ ft., the second floor and roof cantilever entirely around the building. The building is of further interest because the first story is of reinforced concrete flat slab construction while the second story columns and roof are of welded structural steel. Exterior walls consisting only of continuous runs of window sash, galvanized sheet steel spandrels and stainless steel trim produce a minimum of load on the ends of the cantilevers and at the same time impart a distinctive appearance to the building.

In spite of the lightening of the dead loads by careful wall and roof design, foundations for the building had to have considerable capacity as the floors were designed for a live load of 150 lb. per sq.ft. Since the ground at the building site was fill to a depth of 30 ft. and since firm bearing material was not available until a sand stratum was encountered at 80 ft., the decision was to use steel bearing piles. Two 10-in. 42-lb. sections were selected to support each column. These were driven to the sand in two 40 ft. lengths. The procedure was to drive one length, then attach the other by a welded splice and complete the driving. The splice was made by ½-in. plates—two plates 9x12-in. on the flanges and two plates 5x12-in. on the webs. Weld fillets were 3/8-in. in size.

As stated, the first and second floors are of reinforced concrete flat slab construction. The columns, spaced 25 ft. in both directions, are circular, with large flared capitals and square drop panels, and are reinforced with deformed vertical bars and spirals. Four 1-in. bolts 30 in. long projecting from the tops of these columns engage the second story columns which are steel H-sections to which are welded light all-welded transverse roof trusses 50 ft. long. Longitudinal roof framing consists of welded open web joist, braced by channel bridging with welded connections. A conventional steel deck is used covered with 1 in. of insulation. The edges of the roof are stiffened by welded trusses over which the sheet metal

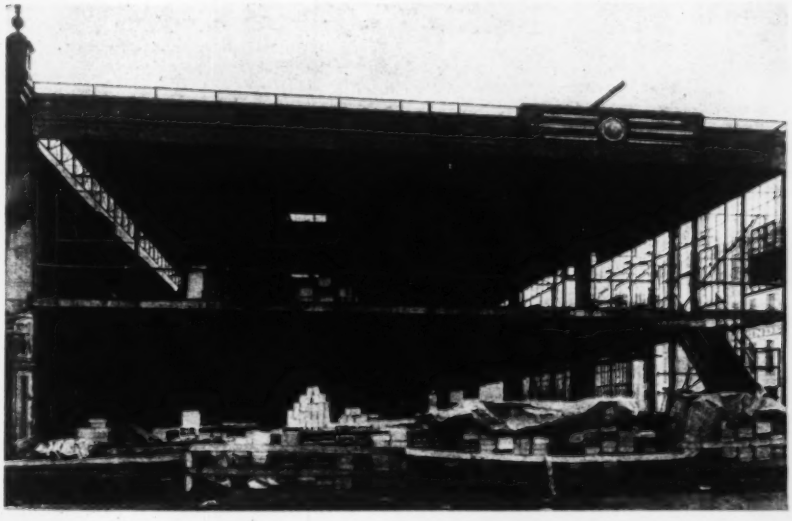


FIG. 1—UNUSUAL FACTORY FRAMING in which the flat slab second floor cantilevers beyond concrete column supports and is surmounted by a second story of welded structural steel with a cantilever roof.

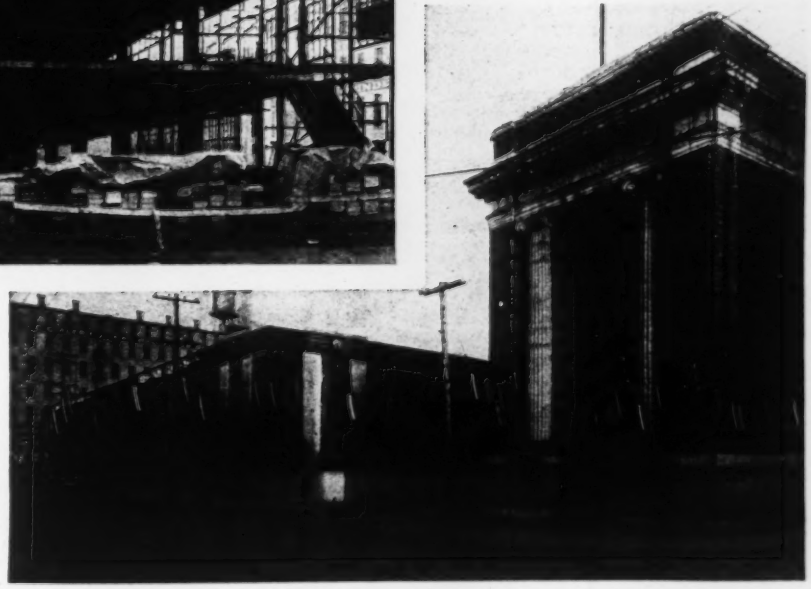


FIG. 2—CONTINUOUS WINDOWS uninterrupted by column pilasters are a feature of the new plant of the Edwards Mfg. Co. in Cincinnati. The picture affords an interesting comparison between two periods of architecture, the Edwards Company's offices, a product of the earlier period, being shown at the right.

Carnegie-Illinois Steel Co. Photos

FIG. 3—WELDED STEEL FRAMING in the top story showing the roof deck and the light weight walls in which galvanized sheet metal spandrels are being applied in the left background.

spandrels are applied. Vertical T-sections welded to these trusses and to a continuous steel channel cast into the edge of the second floor slab serve as mullions for the steel sash and the second story spandrels.

The building was designed by William Carlton, architect of Cincinnati, and the cantilever framing arrangement is attributed to Charles T. Kennedy who assisted in the design. It is pointed out that buildings of various sizes and shapes can be provided by combining a number of these one-bay cantilever units; in such cases the joints between the cantilevers are left open except at the roof where weather-proof flashing is installed; this type of joint was in fact used between the new Edwards building and the old part of the factory that it adjoins. Concrete work was done by the Ferro Concrete Construction Co. and steel erection and fabrication were carried out by William Lang & Sons, both of Cincinnati. The Edwards company, manufacturer of sheet metal products, plans to promote this particular type of building by making available the prefabricated parts that its construction requires.

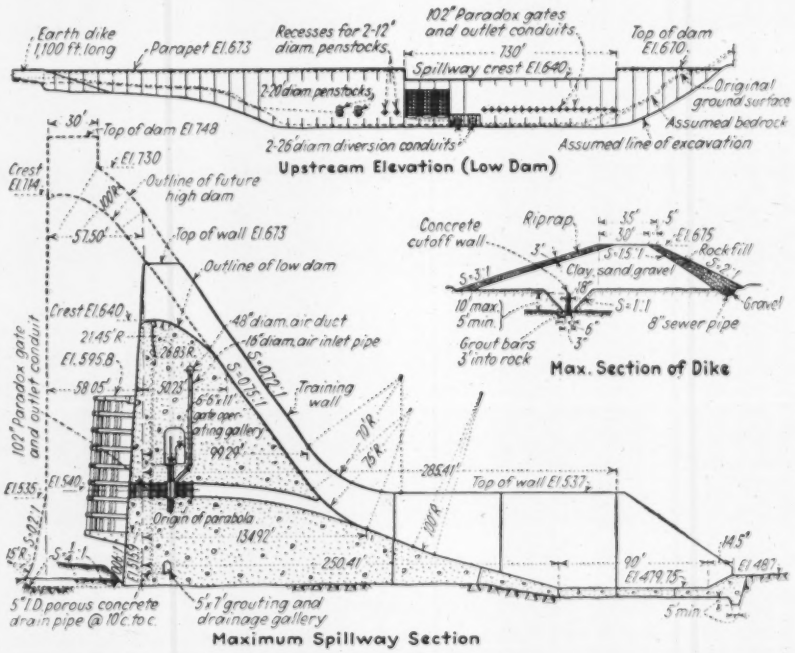
Marshall Ford Dam Designed For Raising in Future

THE MARSHALL FORD DAM, being built by the U. S. Bureau of Reclamation on the Colorado River, 22 mi. upstream from Austin, Tex., is designed for two-stage construction. Present plans call for a straight concrete gravity structure 190 ft. high and 2,325 ft. long, with a 730-ft. overflow spillway at the present river channel. The left abutment of the masonry part of the dam will be flanked by a rolled-earth embankment, 1,100 ft. long, 30 ft. in maximum height and faced on both sides with rock. The dike will contain a low concrete cutoff wall. Ultimately the spillway section will be raised 74 ft. and the non-overflow section 75 ft., giving the dam a total maximum height of 265 ft. The earth embankment will be raised accordingly.

Cross-sections of the low and high dams are shown in the accompanying illustration. The dam will be raised by widening at the back or upstream side, and the plane of the sloping front will be maintained and extended. The present structure will be built in vertical blocks, the joints to be grouted after completion.

Diversion of the river during construction will be through two 26-ft. conduits built into the left end of the spillway section. A hydrograph of the river since 1915 reveals it to be a flashy stream, the flow varying from a mere trickle to a high of 481,000 sec.-ft., recorded during the flood of June 15, 1935. The average flow is about 2,500 sec.-ft. Control of the reservoir will be through 24 paradox gates and outlet conduits 8½ ft. in dia., protected by semi-circular trashracks. Provision is to be made for two 20-ft. penstocks, and recesses will be left for two additional 12-ft. penstocks.

Contract for the low dam, part of the Colorado River project, has been awarded jointly to Brown & Root, Inc., and the McKenzie Const. Co., of Austin, for $5,781,235. H. P. Bunger is construction engineer in charge for the Bureau of Reclamation. Principal quantities include: Earth excavation, including borrow for 67,000 cu. yd., embankment fill, 549,000 cu. yd.; rock excavation, 336,000 cu. yd.; grout, drainage and anchor holes, 70,000 lin. ft.; concrete, 969,000 cu. yd.; reinforcing, 5,300,000 lb.



MARSHALL FORD DAM on the Colorado River in Texas is designed for two-stage construction. In the future the structure will be raised 75 ft. by widening at the back and adding to the top.

CURRENT NOTES ON SEWAGE DISPOSAL

Recent developments in practice summarized by

WILLEM RUDOLFS
Chief N. J. Sewage Experiment Station
New Brunswick, N. J.

● SEWAGE IN THE SEA

Sewage and garbage solids discharged into the sea have a tendency to float and, aside from actually causing pollution, make bathing beaches unsightly. Mechanical comminution or disintegration of this solid matter before discharge takes pl..ce may minimize nuisances. Lupton (*The Surveyor* Jan. 15, 1937) states that although the total quantity of polluting matter is not reduced by disintegration, the breaking up, emulsification, and reduction of fecal matter to a shape less prone to wave-transport has a beneficial influence since this enables purification agencies to operate much more effectively. Tests indicated that with adequate distribution of sewage discharges dilution occurs quickly and the action of marine organisms is so rapid that the *B. coli* count in a large body of water is almost negligible.

● MECHANICAL VS. DIRECT AERATION

The relative merit of compressed air and mechanical aeration in the activated sludge process has been subject to much discussion. Plant scale experiments made at Manchester, Eng. (*ENR* Feb. 18, 1937, p. 272) showed that mechanical aeration by the cone (Simplex) method produced nearly as good an effluent as direct areation with less power cost, but longer detention periods were required. Recent American studies on the purification and settling characteristics cost of operation, construction and operation requirements of a direct aeration unit as compared with a mechanical brush aeration system, using the same sewage, have recently been published by Ridenour and Henderson (*Sew. Wks. Jour.* Sept. and Nov. 1936, and Jan. 1937). Almost identical purification was obtained with both methods but the settling and compacting ability of the sludge formed by the compressed air was greater than that formed by the brush system. Flexibility of control and required attention (in terms of total labor expended throughout an operating year) were about equal for each type of aeration.

The capital cost of installation was about three quarters of 1 per cent more per million gallons of sewage treated for the brush type aeration system. On the basis of aerator construction and operation costs, mechanical aeration by means of brushes was more economical than spiral circulation with compressed air. Circumstances where brush aeration would be superior by virtue of lower power costs occur in cases where simple aeration is used with standby or auxiliary aeration facilities, and where volume of sludge handled is not of importance. At large plants, where sludge digestion and sandbed drying are provided for waste activated sludge, compressed air systems are advantageous because a less bulky type of sludge is produced. Generalizing, it appears that brush aeration would be better for small plants and compressed air aeration for large plants.

● SEWAGE GAS DECOMPOSITION

A given volume of sewage gas produces more heat than the same volume of illuminating gas because of the greater quantity of methane present in the former. Other differences have been noted, and recently studies were made on the decomposition of sewage gas by incandescent coke. Experiments conducted by Tjeenk Willink and Venker (*Het Gas*, 56, 207, 1936) show that high temperature is an essential requirement. Gas consisting roughly of 30 per cent carbon dioxide, 70 per cent methane and traces of hydrogen and nitrogen was passed over incandescent coke heated from 600 to 1000 deg. C. It was found that carbon dioxide decomposed first and that methane was broken down only after the temperature had reached more than 800 deg. C. The maximum number of heating units was obtained in the final gas at 950 deg. C. coke temperature. Beyond this temperature a decrease in heat value occurred. These facts indicate that proper control of gas decomposition should be considered in the design of equipment in which sewage gas is used.

● BOTTLED SLUDGE GAS FOR MOTOR VEHICLES

Attention has previously been called to the use of sewage gas for operating motor vehicles (*ENR* Feb. 20, 1936, p. 288). Latest reports from Germany reveal that sewage gas bottling stations have been installed at Suttgart, Halle and Heilbronn and that similar stations are under construction at Essen and Munich. At these places the sludge digestion gas that would otherwise be wasted is compressed and stored in metal tanks holding about 500 cu.ft. of gas. Three tanks of this fuel will operate a 5-ton vehicle over a distance of about 225 miles. Hundreds of municipal trucks, street sweepers and other heavy transportation vehicles have been equipped to use bottled sewage gas as a fuel.

● OIL FIELD BRINE FILTRATION

Disposal of brines associated with crude petroleum and natural gas production is a problem of increasing magnitude. The methods generally employed in handling the brine consist of impounding in evaporation ponds, discharge into streams, or injection into wells specifically assigned to the purpose. Cooperative studies on other methods of treatment have been in progress in recent years and now Taylor and Christianson (U.S. Bur. of Mines, R.I. 3334, Jan. 1937) present certain results which should guide trial installations of sand filters for brine disposal. They found that under similar conditions of operation all the filter sands tested were equally effective in removing suspended materials from the brine. However, for all-around filtration, greatest duration of filter runs, and smallest initial differential pressure and vertical rise of sand with backwashing, a sand with an effective size of 0.59 mm. and a uniformity coefficient of 1.70 was found to be the best. A sandbed depth of 24 in. proved adequate; the most efficient rate of application was 2.5 g.p.m. per sq.ft. of filter area.

● BULKING CONTROL

Control of activated sludge bulking with chemicals has been tried on a number of occasions. Lime has been reported to help at some plants, whereas at others it aggravated conditions. Chlorine, too, has been used in a number of instances, but it must be applied with great care. Smith and Purdy (*Sew. Wks. Jour.* 8, 223, 1936) reported that bulking sludge could be controlled by proper use of chlorine, applied either to the aeration tanks or in the return sludge prior to mixing with the sewage. On the other hand, experiments at Hagerstown, Md. gave erratic results, possibly on account of varying quantities of chlorine added or because a different type of bulking was encountered. Recent studies by Ridenour, Henderson and Schulhoff (*Sew. Wks. Jour.* 9, 63, 1937) indicate that the filamentous character of activated sludge remains unchanged with the addition of varying quantities of chlorine, and that sludge settling is not improved or purification affected. It appears, therefore, that neither lime nor chlorine can be used under all conditions to control bulking, but that they may be advantageous in specific cases. Before real progress in control can be made it will be necessary to determine the fundamental causes of bulking.

Letters to the Editor

Great Engineers and Publicity

Sir—In your editorial entitled "Good Counsel" (*ENR*, April 15, 1937, p. 566) you say that progress in raising the status of the engineering profession depends less on organization, publicity and bootstrap pulling than on the personal influence of great engineers. Status means relative position or rank. I assume therefore that you are writing of the relative position or rank of the engineering profession in the community.

David A. Pine, Assistant District Attorney in the District of Columbia, in an address to the District of Columbia Society of Professional Engineers informed the members that he told his secretary to look up some of the great engineers so that he might speak of them in his address and that his secretary could find no information on such engineers. That is an example of how far the personal influence of great engineers has raised the status of the engineering profession in the community. "Bootstrap pulling" is merely a wisecrack and contributes nothing to the discussion.

The groups with which I am acquainted that have succeeded in raising their group status in the community have made excellent use of both organization and publicity. I would be glad to hear of any example to the contrary. Professional engineers can improve their status by organization and publicity if they are not too lazy.

JOHN W. DUNHAM

Washington, D. C.
April 30, 1937

A Master Key

Sir—In re your editorial "Good Counsel" (ENR April 15, 1937, p. 566), discussing Hardy Cross' thoughts on engineering teaching by men as compared with teaching by curricula, the writer, whose good luck it was to go to school under Hardy, shouts bravo.

Most distinctly do I remember the days, 21 years ago, when Hardy Cross stressed: "Learn to think." To Hardy, learning the theorem of three moments held less importance than training the mind to steer a straight course through a mental jungle like the one composed by the thrice momented theorem. To Hardy's credit be it said that while he only partly succeeded in teaching us to think, he was highly successful in making us try. Instead of attempting to equip his students with a half dozen keys that opened that number of doors, Hardy Cross was bent on supplying them with a master key that fit all the mental locks.

It would be better to cease for a while the piling up of brick upon brick and stone upon stone around engineering campuses but to heed Hardy Cross' call for souls for the imposing structures.

G. D. HOUTMAN

Media, Pa.
April 20, 1937

Going or Coming?

Sir—Page 547, April 15 issue, carries a photograph showing present state of construction on the Outer Drive link, Chicago. The caption under the photograph mentions the "mouth of Chicago River."

I was of the opinion that engineers made this the source of the Chicago River. Now I'm all confused. I wonder how navigators plying the Chicago River ever know for sure whether they are going downstream or upstream.

H. A. HAWORTH

April 16, 1937
Manhasset, N. Y.

Mr. Haworth can take his pick. It was the mouth, it is the source and it soon will be neither. —EDITOR.

High Surety Bonds Commissions

Sir:—I note in a recent issue of *Engineering News-Record* under the heading of "Stick to Your Knitting" a proposal was being considered by a group of contractors to form its own insurance company, chiefly for the purpose of writing liability insurance and surety bonds.

The writer was, for several years, engineer for a large surety corporation, and it always seemed to me incredible the high commissions paid insurance agents who write the bonds for those whom they consider responsible contractors.

Since they incur no responsibility but only the collection of the premium, it would seem that the furnishing of a small bond would entail the same amount of work as a larger one, still their commissions are figured on a percentage basis as high as 30 per cent of the contract amount; a bond for which a contractor would pay a premium, for example of $6,000 would entitle the agent to $1,800, and for what?

The fact that such high commissions are paid naturally might lead, in some cases, to rebating or the bonding of irresponsible contractors and other objectionable features due to the hesitancy of a surety company to refuse the offering of an agent for a bond on account of other business they receive from said agents and possibly with the thought in mind that this business would more than repay any loss they might incur by writing the bond.

This procedure is of course very unfair to the responsible contractor and could easily be avoided by fixing a reasonable fee for the agents who would then be content with the decision of the surety to write the business entirely on its merits and the usual underwriting requirements.

Because of the payment of the high commissions many contractors are buying interest in small insurance agencies and consequently they receive a return in some form or other for the premiums they pay which gives them an advantage, when submitting bids, over their competitors.

The fact that many of the surety companies show a loss ratio of over 100 per cent in the writing of contract bonds is proof that either insufficient care is taken by many in the investigation of bond applicants, or the premium is too small in which case the remedy would be smaller commissions to the agents which would also allow a reduction in the cost of contract bonds to the benefit of the taxpayer who finally has to pay the bill.

J. C. TYLER

Roanoke, Va.
April 19, 1937

Localized Stress in Brittle Material

Sir—In your article on the failure of the Golden Gate Bridge scaffold (*ENR*, April 22, 1937, p. 590) no mention is made of the localized stresses which probably contributed greatly to the failure of the hanger supporting the scaffold.

It is well known that localized stresses of large magnitude always occur at fillets, holes and other abrupt changes in section of a member. Ordinarily these stress concentrations are not taken into consideration in the design of structural members subjected to static loading if the members are made of a *ductile* material. Ductile materials are accommodating enough to yield locally, and redistribute the stress more uniformly throughout the cross-section without damage to the member. However, if the member is subjected to repeated loading, or if it is made of a *brittle* material, these localized stresses are usually the significant stresses which first cause damage to the member as the loads are increased.

Photographs of the fractured links show that failure of these members occurred on a section at which there was a bolt hole as well as an abrupt change in shape of the member; at these discontinuities there probably were developed concentrations of stress which were the immediate cause of the fracture. Obviously, it was an error in judgment on the part of the designer to choose for the side links a very brittle material, whose elongation in 2 in. was less than 1 per cent as compared with about 50 per cent for structural steel.

The table of physical properties for the aluminum castings used in the side links lists a value of 13,250 lb. per sq.in. for the yield point, but no mention was made as to how this value was determined. If we adhere to the accepted definition of yield point no such value exists for cast aluminum; it is a brittle material having a stress-strain curve similar in shape to that for cast iron.

Engineers engaged in the design of members where failure of a part might cause loss of life must be brought to realize that brittle materials are to be avoided unless a generous factor of safety is used (at least 8 or 10, based on the ultimate strength). For the cast aluminum links a working stress of 2,000 lb. per sq.in. probably should not be exceeded. Furthermore, designers using brittle materials cannot rely on the standard elementary formulas of mechanics; they must take into account the stress concentration factors by which the nominal values of stress (as computed from the elementary formulas) should be multiplied in order to get an estimate of the maximum localized stress which exists at abrupt changes in the shape of a member.

THOMAS J. DOLAN
Instructor in Theoretical and Applied Mechanics
University of Illinois

Urbana, Ill.
April 30, 1937

Land Subsidence Caused by Pumping

Sir—I have read with much interest the article in your April 1 issue on the subsidence of the land surface in the Santa Clara valley in California and your editorial on the same subject.

The area of subsidence is known to be an area in which there has been heavy pumping of groundwater, chiefly for irrigation, for many years (Water-Supply Paper 519). Although I have not made any study of the subsidence in the Santa Clara valley, it seems that there can be no reasonable doubt that it is due to the withdrawal of groundwater, as indicated in the editorial.

F. H. Tibbets' view on pumping in the Santa Clara Valley and its probable relation to the subsidence (*E.N.R.*, Aug. 17, 1933, p. 204) gives strong support to this explanation.

The magnitude of the phenomenon of the withdrawal of the water from storage from artesian aquifiers by compression, when the buoyant force of the artesian pressure is diminished, first became evident to me in work that I did in North Dakota, the results of which were published by H. A. Hard and myself in 1925 in Water-Supply Paper 520-E. In 1928 I published in *Economic Geology*, Vol. 23, pp. 263-291, a paper entitled "Compressibility and Elasticity of Artesian Aquifiers." These papers, so far as I am aware, first treat this subject on a scientific basis. Since this paper was published, much evidence has been accumulating, all of which so far as I know is in support of this theory of compressibility and elasticity and indicates that the phenomenon is one of very great practical importance in regard to our water supplies.

I there referred to the evidence of subsidence from the Goose Creek oil field, and also made some computations on very inadequate data in regard to the artesian basin in the Dakotas, which indicated a compression and consequently a subsidence of 4 or 5 in. It is interesting to note that some geologists and engineers thought it a rather fantastic idea that the area of artesian flow in the Dakotas should have subsided any such amount, although in view of what has taken place in the Santa Clara valley such subsidence seems not at all improbable and might easily have gone unnoticed.

So far as I know, the Santa Clara valley is not essentially different from other heavily pumped valleys in the West, although it may be that it has more finegrained materials, which, of course, have the largest compressibility. The Santa Clara valley differs from many other areas in that it has long been controlled by accurate levels and it would not be surprising if subsidence of some degree due to pumping were found to be much more general than is now supposed. It may not be possible to check on the theory in the artesian basin in the Dakotas unless by looking for evidence of the protrusion of well casings.

D. G. Thompson, of the U. S. Geological Survey, has suggested that the Atlantic City area in New Jersey might be one in which subsidence due to decreased artesian pressure could be determined by running levels to check on earlier levels in that vicinity. In the Santa Clara Valley there is a water table, though artesian conditions also exist, and it is quite possible that the subsidence is due to shrinkage of unwatered material as well as to compression of the ground resulting from reduction in artesian pressure.

O. E. MEINZER
U. S. Geological Survey

Washington, D. C.
April 20, 1937

The Title Adds No Dignity

Sir—I hope you read the speech of Samuel Fassler, commissioner of buildings in Manhattan, before the New York State Association of Master Plumbers on Wednesday. According to the newspaper reports, Mr. Fassler said: "I have always been in accord with the movement to change the name plumber to something that gives a more representative impression. The master plumber, as I have known him over a longe period of years, is an industrious and hardworking individual who fits in the same category as any other highly specialized engineer. His work is technical. It requires long apprenticeship and successful fulfillment of license examinations. Hereafter, instead of using the term master plumber, I am going to substitute the term sanitary engineer."

Be it said to the credit of the master plumbers that they took no action on Mr. Fassler's suggestion. Possible they have come to recognize that a name, no matter how high-sounding, adds no dignity; that Robert Burns' dictum still holds: "Rank is but the guinea's stamp, the man's the man for all that." A master plumber who puts character and faithful performance into his work is more to be respected than the engineer who does not.

And there may be a lesson for both plumbers and engineers in this incident. The engineer bears a title that has been accorded respect because of the high standards maintained for many years by those who have gone before. Until recently the plumber's tasks were those of an artizan, calling for manual skill rather than mental training and vision. But modern building requirements have put new demands on the plumber; for example, he must know and be able to recognize the dangers of cross-connections or back-syphonage. As he rises to meet these new demands, so will greater dignity be accorded his calling.

And as for the engineer, no one knows better than Mr. Fassler what shoddy work *can* be done by men who call themselves engineers or architects. If his contact with those members of these two professions who catered to the demands of speculative builders in the mad days before 1929 has lowered his esteem for engineers, who is to blame?

ONE OF THE ENGINEERS

New York, N. Y.
April 22, 1937

Spherical Trigonometry Neglected

Sir—Spherical trigonometry for obtaining the bevels in the structural steel framing of hip and valley roofs and skewed portals, in hoppers, pipelines etc. seems to be very little used and almost entirely unknown, although a number of writers have called attention to it. Among the articles published on the subject are those by C. A. P. Turner, *Engineering News* February 15 and 22, 1900 and Hart Vance, *Engineering News* September 1, 1910. Possibly one reason for the lack of use of this method is that many engineering graduates have not studied spherical trigonometry in school, as it is usually an elective subject. However, a working knowledge can be acquired in a

short time and the effort will be found well worthwhile in the added facility given in making required calculations.

No special formulas need be developed since the application of the standard formulas of spherical trigonometry is made directly to each type of problem. If data on the different cases is desired for incorporation in the drafting room standards these cases can be clearly illustrated by perspective drawings, with the spherical triangles shown in position. It will be found that a perspective is much easier to understand than an orthographic projection.

In general, the problem as encountered in the case of hip or valley roof framing and hoppers consists of connecting two material planes by means of a bent plate. In roof framing one of the material planes will be either the flange or web of the rafter and the other material plane will be either the flange or web of the purlin. Whatever two material planes are involved we have given the dihedral angles made by these material planes with the horizontal plane and the angle made by the traces of the two material planes on the horizontal plane.

The trihedral angle formed by the three planes just mentioned determines a spherical triangle in which we have given two angles (the dihedral angles made by the two material planes with the horizontal plane) and the included side (the angle between the horizontal traces of the two material planes) to find the third angle and the two remaining sides.

The third angle of the spherical triangle when determined will give the dihedral angle between the two material planes, and this will be the bevel of bend on the bent plate connecting the two material planes. The two remaining sides when determined will give the bevels of the intersection line ("bend line") to each of the two connecting members.

A routine method in detail similar to that given above for roofs and hoppers can be established for the calculations found in skew portals and pipelines.

C. H. Hittle
April 7, 1937 Chief Engineer
Lebanon, Ohio The Oregonia Bridge Co.

From Job and Office

Cooper's Engine Loading Reduced to Formula

By Roy E. McFee
Detroit, Mich.

IN CONSTANT USE in every railroad designing office is the table of maximum shears, floorbeam reactions, and moments based on Cooper's loading. Generally the use of these figures is a blind procedure. Their derivations are obscured in lengthy computations, and no relationship among them is apparent on the surface.

However, in the accompanying diagram, where these functions are plotted in dotted lines for Cooper's E-60, it will be noted that, between the span limits of 25 and 125 ft. for shear and moment, and between 25 and 100 ft. for floorbeam reaction, these dotted lines follow surprisingly close to the regular curves, shown in full lines.

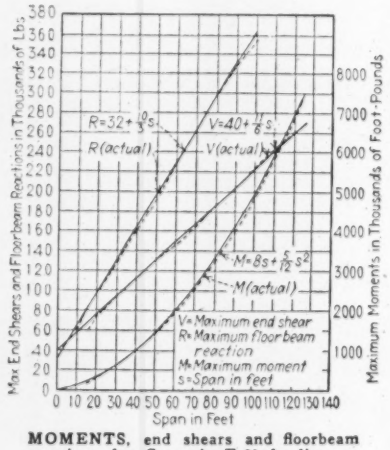
Obviously, it is an easy matter to reduce these regular curves to formulas. These, within reasonable error, would then be empirical formulas for maximum shears, floorbeam reactions, and moments corresponding to Cooper's E-60 and be in thousands of pounds and thousands of foot-pounds, for one rail. These formulas follow:

$$V = 40 + \frac{11}{6}s$$

$$R = 32 + \frac{10}{3}s$$

$$M = 8s + \frac{5}{12}s^2$$

where V equals the maximum end shear, R equals the maximum floorbeam reaction, M equals the maximum moment, and s is the span in ft. It happens that these three formulas have a likeness of form and a peculiar relationship of coefficients, which should make them easier to remember. For loadings other than E-60 the same formulas can be used, and ratios applied to the results.



MOMENTS, end shears and floorbeam reactions for Cooper's E-60 loading on one rail.

Suppose it is desired to find maximum shear, floorbeam reaction, and moment for a span of 48 ft. Then

$$V = 40 + \frac{11 \times 48}{6} = 128$$

$$R = 32 + \frac{10 \times 48}{3} = 192$$

$$M = (8 \times 48) + \frac{5 \times 48^2}{12} = 1{,}344$$

These are values for E-60. If values for E-70 are desired, multiply the E-60 values by 70/60.

Investigation shows that the greatest percentage of error from these formulas is 2.9 per cent, for moments in spans of 99, 100, 101, and 102 ft., and that this error is on the side of safety. The greatest error against safety is 0.75 per cent for shear in a span of 100 ft. In the shears especially, the error is usually much less than 1.0 per cent. It is noteworthy that even for spans less than 25 ft. the error, although greater, is still on the side of safety.

It is not suggested that these formulas be used in actual designing where tables are available. However, if necessary, they will give results sufficiently accurate for any purpose. They should be convenient to carry in mind on field trips. And even when tables are being used, these formulas may perhaps give a little clearer picture of the relation of span to live load stresses.

Sealing Off Water In Pier Sinking

THE viaduct approaches to the new Outer Drive Bridge in Chicago (*ENR*, May 6, 1937, p. 671) are supported on circular piers 4 to 6 ft. in diam. built in open caissons sunk 85 to 100 ft. to rock by the Chicago method of driving vertical lagging and excavating with a bucket. However, because 25 ft. of water-bearing sand overlaid the blue clay on the north side of the river a modification of the method was necessary in this section to start the excavation and to exclude the water. The method may have utility elsewhere.

A ring of steel sheetpiling of sufficient length to penetrate from 4 to 5 ft. into the clay was first jetted and driven concentric and 1 to 1½ ft. larger in radius than the proposed sub-pier. After bracing this sheeting against external pressures, the sand was removed, but it was found that so much water seeped in that some means had to be devised to exclude it before any further excavation by the regular open Chicago method could be undertaken. The solution was a special sump built at the surface of the clay.

Two concentric rings of lagging were driven into the clay, the inside surface of the inner ring coinciding with the face of the finished pier. The outer ring bisected the distance between the

inner ring of lagging and the steel sheetpiling. The clay between the two rings of lagging was then excavated to within 1 ft. of the bottom of the lagging and this space entirely filled with a rich concrete mixture. When the concrete had set, the space between the concrete cylinder and the steel sheetpiling acted as an effective sump from which the seeping water was continually pumped out. The pier space was then excavated in the dry down to solid rock.

A method, similar in objective but differing in detail, used on another section of this work, was described in (*ENR*, Jan. 28, 1932, p. 135). Here instead of steel sheetpiling, a steel cylinder equipped with special jets was sunk into the clay and thus sealed off the water, permitting use of the Chicago method.

Using the Engineer's Transit To Determine Orifice Coefficients

By Prof. Thomas D. Smith

School of Engineering, University of Delaware Newark, Del.

IN DETERMINING the contraction coefficients for a standard orifice the customary way of measuring is to caliper the contracted section. This is usually done by inclosing the jet with a ring containing finely pointed screws. This method is not entirely satisfactory as it is necessary to use a very low head or else it will become difficult to maintain in an accurate position the apparatus used for determining the values of x and y. Another method is to determine the coefficients of velocity and discharge and to use their ratio for the value of the contraction coefficient. The latter method has been used by the writer for the past two years in the hydraulic laboratory at the University of Delaware, but the engineer's transit has been used to secure additional accuracy and to increase the students' interest in the experiment.

Details of method

A plan of the layout used in determining coefficients with the engineer's transit is shown in Fig. 1. The line *ab* represents the horizontal projection of the jet and the line *cf* presents a base line parallel to, and 7 ft. from, the plane of the jet. The diameter of the orifice is ½ in. and its area is 0.001363 sq.ft.; *c* is a point on the base line in the vertical plane of the orifice plate. The origin for the x coordinate is located 0.5d from the point *c* when d is the diameter of the jet. In other words the origin on the base line for the x coordinate corresponds to the vena-contracta of the jet. The transit is set up on the base line at a point 2 ft. from the origin of the x coordinate and the vertical angles to the center of the jet are measured. The horizontal cross hair of the transit is easily centered on the jet, but it may also be set on the upper and lower edges

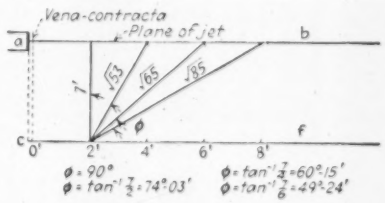


FIG. 1—PLAN of set-up for determining orifice coefficients by using an engineer's transit.

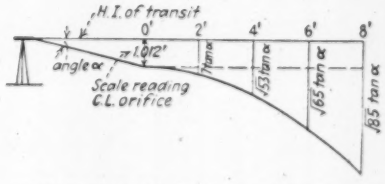


FIG. 2—METHOD of determining scale readings and vertical angle.

of the jet and the average value of the angle used. The height of the instrument is obtained by taking a scale reading on the center of the orifice. This scale reading is subtracted from the computed vertical side of each right triangle. Fig. 2 shows the vertical angle and the scale reading on the center of the orifice. This same experiment has been performed by setting the transit at points, 4, 6, 8 and 10 ft. from the orifice of the x coordinate, and turning 90 deg., as described for experiments taken at 2 ft. from the orifice.

The accompanying tables were derived from the same experiment as shown in the illustrations.

No of Run	Diameter Orifice Ft.	Head At Beg. Run	Head At End Run	Weight of Water	Q in c.f.	Time Seconds	Q c.f.s.	Coefficient C
1	.0417'	4.42	4.50	617.5	9.880	696.2	.001409	0.6143

Average Head = 4.46

Orifice area = 0.001363 sq.ft.

X	Vertical Angle	Computed Vertical	Y	$V = \sqrt{\frac{gx^2}{2y}}$	$C_v = \frac{V}{\sqrt{2gh}}$	$C_c = \frac{C}{C_v}$
2	10°—03'	1.2406	0.2286	16.784	0.9908	.....
4	15°—01'	1.9530	0.9410	16.546	0.9767	.....
6	21°—02'	3.100	2.088	16.660	0.9836	.....
8	27°—03'	4.708	3.696	16.697	0.9857	.....
Average value.....					0.9842	0.6242

Measurements of Slip In Ring-Connected Timber Joints

WHEN split ring connectors were adopted for extensive use in two street bridges built recently at Port Angeles, Wash., it became desirable to demonstrate to officials of that city the effectiveness of this type of construction. Accordingly, Conrad O. Mannes, construction engineer, W.E.R.A., took to Port Angeles four 4-in. split ring connectors and a tool for cutting grooves in timber to receive them. Two posts and a cap were set up and from the cap a box containing 4 cu.yd. of gravel was suspended by splice pads with two rings in the cap and two supporting the platform as shown in the accompanying sketch.

The gravel was wet and weighed about 14,000 lb. The recorded slippage even under the rough methods used on a field test showed the following amounts at the four points on which observations were made: point No. 1, 0.021 in.; No. 2, 0.042 in.; No. 3, 0.042 in.; No. 4, 0.010 in.

Subsequent observation over a considerable period of time showed no material increase in these values.

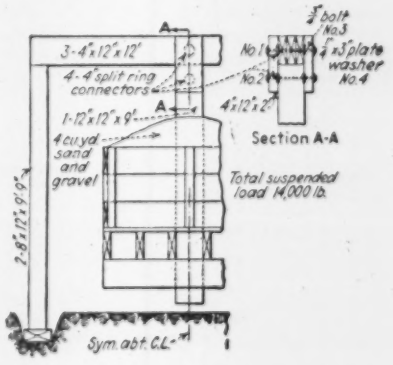


FIG. 1—DEMONSTRATION in which a joint made with two 4-in. split ring connectors supported a load of about 14,000 lb.

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Editorial offices at 330 West 42nd Street, New York

May 13, 1937

Toward Safer Buildings

THE prison sentences meted out to the builders of an apartment house that collapsed in New York last June and resulted in the loss of eighteen lives should act as a strong check on other builders who may be tempted to compromise safety to reduce cost. But if the effect of the fatal accident of last June is permitted to end there the architectural and engineering profession can hardly hold themselves free of responsibility for like accidents in the future when speculative builders have forgotten about that collapse. The fact that eighteen men lost their lives because the law does not require adequate supervision of construction should be kept before the state legislators until a requirement for adequate supervision is made a part of the basic law of New York state. Once such a requirement is written into the laws of New York state it will be easier to get it adopted elsewhere.

Not a Structural Failure

IF ONE GOOD THING CAN BE SAID about the tragic destruction of the Zeppelin *Hindenburg* it is that structural failure was not the cause of the disaster; probably played no part in it. About few previous failures of lighter-than-air craft can this same statement be made. So far as the United States is concerned, its *Shenandoah, Akron* and *Macon* all fell prey to forces greater than their structures could withstand. German-built ships have a better record. Our own *Los Angeles* is one of them, and she lived out her life without mishap. The *Graf Zeppelin* has made 555 flights and carried 13,000 persons over a million miles. Even the *Hindenburg* had seen a year of service. Structurally these ships were and are a success. The *Hindenburg* burning mocks this success, by emphasizing the danger of using a flying inflammable-gas tank to carry passengers. Hydrogen and its advantage of great lifting power and low cost must give way to the safer helium, if lighter-than-air craft are to have a future. The use of helium, with its smaller lifting capacity, will require larger ships if present pay loads are not to be reduced. Larger ships mean new structural problems. Somewhat paradoxically, therefore, the *Hindenburg* disaster, while not attributable to structural weakness, nevertheless will focus new attention on the structural design of airships.

To Avoid Congestion

IMPRESSIVE PROOF of the growing cost of traffic congestion is found in the number of steps taken recently to provide new traffic tunnels, both here and abroad. In New York the state legislature has authorized the New York City Tunnel Authority to issue bonds to finance construction of a cross-town tunnel under Manhattan to connect the Lincoln Tunnel under the Hudson River, one tube of which is nearing completion, with the tunnel recently started under the East River. Similarly, the tunnel authority is authorized to build the long projected Narrows Tunnel, provided it can sell its bonds. Abroad, a tunnel under the Thames is projected at London and work will start soon on one under the Maas River at Rotterdam. The cost of these facilities is enormous but so is the cost of street congestion in cities where a large percentage of the traffic is commercial. As delays begin to be counted in dollars the commercial interests of great metropolitan areas are bound to turn to any means that promise to speed transport. The vehicle tunnel and the overstreet viaduct are definite future developments of great cities.

Neglected Bridges

SOME CURRENT FIGURES GIVE DEFINITE EXPRESSION to the well-known fact that bridge modernization has lagged behind road improvement. The figures are for California, where a survey has shown that 250 bridges are so weak that they need to be replaced immediately to safeguard traffic. The list includes venerable relics of the past, one of which has reach the hoary age of 81. However, many other bridges are only slightly less obsolete and must be included in a progressive bridge-replacement program to be carried out during the next few years. The condition found in California is in no way unique. Weak and narrow bridges exist by the thousands in several sections of the country, and even in the states of heaviest travel and most fully developed road systems the traveler may find bridge after bridge on main highways posted for limited capacity or more obvious hazard. In short, obsolescence of minor bridges is one of the greatest weaknesses of our present highway system. Correspondingly, the execution of consistent bridge-renewal programs supported by regular allocation of funds is a major requirement in every state.

Underground Supply Limitations

LONG ISLAND'S WATER EXPERIENCE holds a warning for every region dependent on groundwater for its existence. In the growth of each such region, wells furnish an ample supply at first and the small draft gives rise to no difficulty, but as more wells are sunk and the draft increases, signs of trouble appear. A few wells lose their water or become brackish at times. Later others give trouble, and finally it is evident that the supply is overtaxed. There arises the problem of reducing and readjusting the use of water—one of the most difficult known problems of water rights and water control. The difficulty is increased by the fact that the wells first to fail are not necessarily those responsible for the overdraft, and the fact that after exhaustion of the surplus water originally stored in the ground the continuous safe yield is less than the amount previously used. Under such circumstances, determining where to correct the condition of overdraft and how to regulate draft with fairness to all is bound to be a matter of arbitrary procedure; and belated establishment of a code of underground water rights does not relieve the harshness of the procedure. Many of the difficulties can be avoided, however, if the supply conditions and safe yield of the underground source are thoroughly explored before trouble develops. It then is possible to control well drafts without injustice and to conserve the supply. For this reason every state would best serve the people by making full study of all underground basins and setting up a control system to regulate well sinking and drafts in the interest

of the entire region concerned. Our extensive groundwater zones, especially those of the coastal plain, are so generally nearing a critical supply condition that this course of action is one of the most urgent of public needs.

To Make Schools Safe

LESS THAN TWO MONTHS ago the country was shocked by the news that hundreds of children had been killed in the explosion of a Texas schoolhouse. Mystery added to the horror of the event, for its causes were obscure. Yet it was realized at once that some inherent element of unsafety in the school itself rather than external violence was responsible.

Immediately afterward the serious work of searching out the nature and origin of the explosion began. The results reported by the investigators leave no doubt as to what occurred. If fully heeded the lessons taught will assure against repetition of such disaster.

To summarize the facts: gas leaked from mains which had been built by incompetent persons; it pocketed in the enclosed cellar space under the main floor; it was set off by a spark produced in operating a faulty switch; and as a result of the explosion the whole building collapsed like a house of cards. That such conditions could exist in a modern school building, especially where no motive for niggardly economy was present (the school district is described as the richest in the United States), is a regrettable commentary on the attitude of school officials toward their duty and on the supervision exercised by higher authorities.

Dependable safeguards can be and must be erected against the gross hazards that combined to bring about the disaster. Faulty gas equipment installed by incompetent persons has no place in a school, nor have dangerous electric appliances. Unventilated closed spaces where gas may pocket should be avoided, but as even the most ample provision of ventilation may not always be effective it is clearly better to prevent release of gas by insisting on substantial and workmanlike construction than to rely on removing it after it has entered the building. So also the addition of malodorants to gas, recommended by the investigators to aid detection, is an indifferent substitute for tight gas lines.

Safe construction is the prime teaching of the Texas explosion. And this teaching has fully as much application to the structure of the building itself as to its items of installation. Unfortunately the reports of the investigators, concerned primarily with the gas hazard, say nothing about the building structure or about the utter collapse of the roof, under which many of the victims were found. But the shattered ruins told their own story.

A substantial frame carried securely to good foundations independent of the building is the first requirement of safe building construction. Repeatedly in the past, building disasters have shown the tragic results of violating this requirement—as when, some years ago, the wall-supported roof structure of a Washington theater fell down on the audience, crushing scores to death. That a substantial frame can resist even a gas explosion violent enough to shatter walls and floors was shown in the Columbus state office building accident five years ago; no lesser degree of structural robustness is tolerable in a school building. The added cost of a well built frame is negligible, and if only a single life had been saved by survival of the roof trusses and frame of the Texas school the expense would have been many times weighed up.

The lesson of good construction taught by the Texas tragedy deserves thorough study and countrywide dissemination. It is one to be learned by architect, engineer, school official and citizen alike.

Too Many Engineers?

THE COMPLAINT often is heard that the engineering profession is overcrowded; and taking that assumption as a premise, it is argued that the number of young men studying engineering should be materially reduced. Superficially, such a conclusion may appear warranted, but when the subject of education is viewed more completely one finds good reason to believe that the conclusion is unjustified.

Recently newspapers carried on their financial pages the announcement that Joseph H. Nuelle had resigned as president of the New York, Ontario & Western Ry. to become president of the Lehigh Coal and Navigation Co. Reading down through the notice this statement is found. "Mr. Nuelle started as a rodman on the Ontario & Western in 1908, becoming, successively, assistant engineer, engineer of maintenance of way, chief engineer and assistant general superintendent . . . becoming president in 1930." Similar statements will be found in the biographical records of many men holding high executive positions that, superficially, appear to be far removed from engineering. Were these men crowded out of engineering, or did engineering simply serve them as a stepping stone to better things?

It may be claimed that native ability, not engineering training, helped these men ahead, and the claim cannot be denied. But when it is realized that many of these men progressed upward from the bottom of large organizations where engineers are very much in the minority among a multitude of employees enjoying equal opportunity, it can hardly be denied that the larger pencentage of engineers who reached the top is not simply a matter of chance. The evidence points to the conclusion that their engineering training aided their progress.

In law, architecture and medicine as well as in engineering the statement frequently is heard that there are too many young men crowding in at the bottom. It can hardly be said, then, that the alleged overcrowding is peculiar to the engineering profession. Rather, it is characteristic of almost all the channels through which men make their living. Such being the case, it is neither logical nor just to restrict opportunities for entrance to the major professions. Those who are already in may not in justice attempt to improve their position by denying opportunity to those who follow.

Rather, what should be attempted is to reduce the number of misfits by proper vocational guidance. In engineering, this doubtless will result in the training of more young engineers than the profession can absorb permanently. But the record shows that the young man who can stand the rigors of an engineering-school training is better trained for his future career than if he had taken some other course of training. Thus the young men benefit by such a procedure. And the profession itself also benefits, both by the stimulation of sharper competitive effort and by the assurance that potentially brilliant engineers are not forced out of engineering by any limit on those who would enter that field.

CURRENT NEWS

Six Men Sentenced In Building Crash

Four are jailed and two get suspended sentences from manslaughter charges on Bronx apartment collapse

Six men who were convicted of second degree manslaughter as the result of the collapse last June of an apartment house under construction in the borough of the Bronx, New York City, in which 18 workmen were killed, received sentence last week. Four received jail sentences ranging from six months to two years, and two received suspended sentences.

Prison terms of two to five years were imposed upon Louis Steinberg and his son, Max, owners and builders of the apartment house. A similar sentence was meted out to Vincent A. Valentine, the masonry contractor on the building.

Alfred F. Heine, former masonry inspector for the Bronx building department, who was inspector on the building, received six months in jail.

Michael C. Thiede, former plan examiner for the building department, and Harry C. Rutkins, the architect, received suspended sentences. The judge remarked in connection with the suspended sentences that he had considered the fact that both men had lost their positions and that neither of them had seen the actual building during its construction.

It was claimed by the state in the course of the trial of the six defendants that Steinberg and Valentine, the contractors, were guilty of improper construction in violation of the building code. Improper practices charged included the use of shaped headers in the masonry, poor mortar, failure to flush up the masonry, and failure properly to anchor the beams. It was also stated that deep chases were cut in load-carrying piers.

It was asserted that Heine, the masonry inspector, negligently failed to discover and halt these practices.

The charges against Rutkins, the architect, and Thiede, plan examiner, arose in connection with the absence of supporting grillage under the main beams carrying a heavy tower on the roof. It was charged that Rutkins showed negligence in failing to provide such grillage and that Thiede should have discovered its absence in his examination of the plans.

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Charters of Building Locals Revoked by C.I.O.

The Committee for Industrial Organization last week revoked the charters of ten unions recently organized in the building trades as locals of the International Union of Mine, Mill and Smelter Workers, a C.I.O. affiliate. The action will affect locals in 13 eastern states.

This action was taken, according to Sidney Hillman, president of the Amalgamated Clothing Workers of America and C.I.O. official, when the C.I.O. discovered that Patrick J. Commerford, who had been organizing the locals, had been sentenced in 1932 on federal income tax charges to a year in Atlanta after a trial in which he was accused of selling out the interests of labor to building contractors and that as organizer for the Mine, Mill and Smelter Workers he had been extending the jurisdiction of the union to include charters to locals of hoisting engineers, oilers, bricklayers, and "even cleaners and dyers."

Mr. Hillman stated that "the membership of these locals . . . belongs in the locals that have jurisdiction in their field of work."

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Long Controversy in New York Fails to Defeat Gas Tax

A deadlock of nearly a month's duration was ended May 4 when the Republican-controlled Assembly of New York finally abandoned its opposition to Governor Lehman's plan to increase the present 3-cent-a-gallon tax on gasoline to 4 cents.

A bill providing for the increased tax was defeated in the Assembly April 7 when seven Democratic assemblymen broke down party lines and refused to vote for the tax. The ensuing deadlock, which held the legislature in session for nearly a month past its originally planned adjournment date of April 14, was only broken when the assembly Republicans finally yielded to the Governor's insistence that an increased tax was necessary, to provide revenue for appropriations already made, and passed the bill in an amended form.

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Rhode Island Law Provides For Freeway Construction

The Rhode Island legislature recently enacted a bill providing for the construction, maintenance and improvement of freeway highways. Such highways are defined in the bill as "A way especially designed for through traffic over which abutters have no easement or right of light, air, or access by reason of the fact that their property abuts upon such ways."

The bill provides that the director of public works and the division of roads and bridges shall have power to establish and maintain freeways within the state in the same manner and with the same authority which it now exercises over regular highways. Existing easements of access, light or air, it is provided, may be extinguished by purchase or by taking under eminent domain.

Access to any freeway from an existing highway may be regulated and restricted by the director of highways, and access from any new highway will be subject to his consent.

New Building Code For New England

The New England Building Officials Conference adopts a building code for the New England Area

A comprehensive recommended building code has been adopted for use in New England, containing provisions for continuing scrutiny of its subject matter and flexible application as the art progresses. The code, known as the "Uniform Building Code, 1937 Edition," was prepared by the New England Building Officials Conference under the leadership of Edward W. Roemer, building commissioner of Boston, and adopted without opposition at a meeting of the conference last month. The code is based on the draft code adopted in 1932, and has been influenced by the work done by the Pacific Coast Building Officials Conference, the building code committee of the U. S. Bureau of Standards, the building code recommendations of the National Board of Fire Underwriters, and the building exit code of the National Fire Protection Association.

The attempt by the Building Officials Conference to adopt a code uniform throughout New England which could replace the widely varying and in some cases antiquated building laws and codes of the cities and towns began in 1929. After two years of cooperative work by regional and other committees connected with the New England building industry a tentative code was adopted in 1932, and the 1937 edition has been drawn upon the basis of widespread discussion and criticism of that draft.

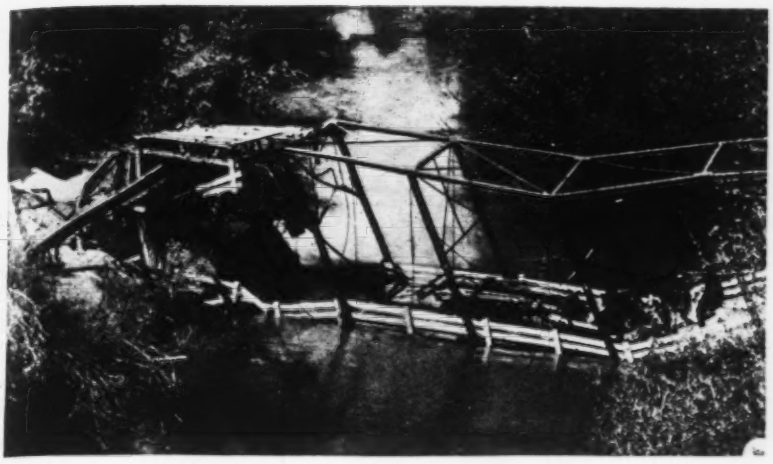
Leaves wide discretion

The code proceeds upon the principle that an owner is entitled to build upon his land in whatever manner he pleases, so long as he does not endanger the health and safety of others, or infringe upon their equal rights. It does not attempt to list all the things a builder may do, but rather interprets the general law requiring safe construction, specifying only the minimum requirements of safety and leaving wide scope to the architect and designer. The major topics cover administration, fire limits, occupancy, walls, openings, floors, roofs, exits, chimneys and heating apparatus, loading, materials, excavation, foundation, gas fittings, and others. A section on plumbing will be adopted shortly.

Higher resistance

The code provides for six types of construction, rather than the usual three. 1. Fireproof; 2. Semi-fireproof; 3. Heavy timber and masonry; 4. Light wood and masonry; 5. Metal frame; 6. Wooden frame. Fire protection and fire resistance are specified by performance, and all the known material which will resist fire from one to three hours are listed in the code. Fireproof buildings are defined as those in

(*Continued on page 722*)



COLLAPSE of a bridge near McMinnville, Ore., resulted when a power shovel mounted on a truck collided with the portal bracing.

Oregon Bridge Collapses When Struck by Shovel

The Whiteson steel bridge across the north Yamhill River on the West Side Pacific Highway two miles south of McMinnville, Ore., collapsed May 2 when its portal bracing was struck by the boom of a power shovel being carried across it mounted on a truck. The load was within the legal limits, but its total height above the pavement was 13 ft. 6 in., while the maximum vertical clearance of the bridge was 12 ft. 10 in., according to Glenn Paxton, bridge engineer of the Oregon state highway commission, who sat on the board of inquiry.

The bridge was a steel pin-connected Pratt truss with a 159-ft. span. It was built by the county in 1912 and later taken over by the highway commission and was an important link in the West Side Pacific Highway between Portland and Junction City, Ore.

The power shovel, going north, struck the south portal nearly in the center, bending it and pulling the two trusses together. This threw the top chord out of line, and the truss collapsed; the bridge deck fell, pulling the south pier over with it. The pier was a steel tube filled with concrete. The bridge deck, truss, truck, and shovel went down together, coming to rest at the bottom of the river, which is shallow at this point. The driver of the truck was injured but not fatally. There was no other traffic on the bridge at the time of the accident.

J. N. Bishop, maintenance engineer, and I. A. DeFranc, maintenance superintendent of the division in which the bridge is located, went to work immediately on a temporary trestle to span the river.

Mexico and United States In Sanitation Project

The first joint international sanitation project of the governments of Mexico and the United States has been authorized by the U. S. Department of State. The International Boundary Commission will award a contract about July 1 for the $230,000 international sanitation project in the lower Tia Juana Valley. Half of the amount will be contributed by each government.

An outfall canal about 10 mi. long will be built to the Pacific to drain sewage from communities on both sides of the boundary line, including Agua Caliente and Tia Juana on the Mexican side and San Ysidro and parts of San Diego County on the American side. The project will abate the pollution of the Tia Juana River, which is dry in some months. It is expected that the project will be completed in six or eight months.

All work in connection with the project will be directed from the El Paso office of the American Section of the International Boundary Commission.

War Department Establishes New Division

A new division, to be known as the Southwestern Division, with headquarters at Little Rock, Ark., has been set up by the War Department in an order dated April 28. The territory of the new division now lies in the present Lower Mississippi Valley Division.

The Southwestern Division will have jurisdiction over the Arkansas River and its tributaries above, and excluding, the city of Pine Bluff, Ark.; the White River and its tributaries above Peach Orchard Bluff, Ark.; and the Red River and its tributaries above Fulton, Ark.

A new river and harbor district is established at Little Rock, Ark. embracing that portion of the Southwestern Division not included in the present Conchas District, and the Conchas District is transferred from the Lower Mississippi Valley Division to the Southwestern Division.

Lt.-Col. Eugene Reybold, district engineer at Memphis, has been appointed chief of the new Southwestern Division. He will be replaced at Memphis by Major Daniel Noce, previously assistant in charge of the Passamaquoddy project and at present attending the Army College at Washington.

Detroit Builders Stop Work

House building contractors faced with demands for closed shop will take no new contracts

The Greater Detroit Builders Association of Detroit, Mich. at a meeting May 3 determined that members would take no new contracts until the labor situation in the Detroit building trades becomes stabilized. The association includes 169 building contractors doing about 80 per cent of the residence construction in the Greater Detroit area. Contracts in force, according to the plan, will be continued, and buildings now under way completed.

This action follows presentation of demands by local building trades unions for increased wages and closed shop conditions. Building construction work in Detroit is at present open shop. Although no general building trades strike or lockout exists, the plasterers are on strike, asking $1.75 an hour as compared with the 90 cents and $1 an hour they are now getting. Bricklayers are asking $1.50, while the contractors are willing to pay $1.25. Carpenters want $1.25 as compared with an offer of $1 an hour.

The contractors contend that "We can't keep in business and pay the wages the workers demand." With mortgage loans based on January 1937 appraisals, it is the contention of the contractors that construction costs are too uncertain under present conditions to warrant entering into new contracts and that therefore more stable labor conditions are to be awaited.

Building contractors in Detroit have reorganized the Associated Building Employers for the purpose of handling labor problems. Although not affiliated with this organization, the Greater Detroit Building Association is cooperating with it in an effort to maintain the open shop. The Associated Building Employers was organized in 1920 during the plumbers' strike and was active in the building construction industry until 1933, when its operations were temporarily discontinued.

Unlicensed City Officials Forced Out by Society

The city engineer of Oklahoma City has taken leave of absence pending action on his application for an engineer's license, and the superintendent of the water department has resigned, as a result of pressure from the enforcement committee of the Oklahoma Society of Professional Engineers.

J. S. Waldrep was appointed city engineer and Carl Staas water superintendent by a newly elected city council. Neither man was a licensed engineer.

The Oklahoma Society of Professional Engineers, stating that "It appeared to the officers of the society that these appointments were in violation of the registration statutes," exerted pressure on the city administration.

As a result of this action, Mr. Waldrep was given an indefinite leave of absence until the board of examiners should pass on his pending application for a professional license, and Mr. Staas resigned.

Water Treatment is Featured At Delaware Meeting

EXPERIENCE in handling unusual problems in water plant operation was featured at the annual conference of the Maryland-Delaware Water and Sewerage Association held in Wilmington, Del. on May 6 and 7. More than 130 members of the Association attended the two-day session devoted to a review of recent advances in sanitation practice.

The removal of manganese by use of sulphur dioxide gas was described by J. D. Patrick, chemist, West Virginia Pulp & Paper Company. The raw water for the paper mill is heavily contaminated with industrial waste and the 12 mg.d. filter plant is overloaded. Remedies were sought to keep the filters in good condition; caustic soda and chlorination were tried, but the results were not satisfactory. Having previously noted that sulphur dioxide effectively precipitated manganese dioxide hydrate which formed on pipes in the system, Mr. Patrick made laboratory tests in cleaning filter sand with a 3 per cent solution of sulphur dioxide. Investigation on the plant filters revealed that the 3 per cent solution was too strong for ordinary cleaning purposes but a 0.2 of 1 per cent solution was found to give good results. The solution is applied to the filters through the underdrain and it requires only a few hours of contact to thoroughly clean the filters. The application of sulphur dioxide not only cleans the sand but also cleans the ports in the metal collector pipes; it is not dangerous to use. Patents for the application of this method to cleaning filters have been taken out in the United States and applied for in Canada.

More than $10,000 was spent for extra treatment in combatting a heavy growth of the micro-organism *Synedra* in the raw water of the Dalecarlia filtration plant in Washington, D. C. during the period Sept. 15 to Oct. 5, 1936, according to Carl J. Lauter, chief chemist of the plant. The *Synedra* increased from a normal count of 2 or 3 per c.c. to more than 4000 per c.c. thereby cutting down filter runs from 60 hours to 1 and 2 hours. The extra treatment included chlorine and copper sulphate additions and increased dosages of alum and hydrated lime; about 80 days of normal treatment were consumed in the 20 day period of high *Synedra* count. The excess chemical cost per million gallons treated was $4.10; excess wash water used in this period amounted to 29 m.g.

Water pollution tests

Urging higher standards in water bacteriology tests, Dr. J. F. Dominick, bacteriologist of the Dalecarlia filtration plant, Washington, D. C., stated that where dysentery epidemics have occurred it has been shown that organisms were present in the water that sometimes escape laboratory detection. Dr. Dominick revealed that in autopsies which he conducted *B. aerogenes* were present in the small intestines of humans although this organism is commonly assumed to occur only in soil. In the lower intestine *B. coli* was predominant but the *aerogenes* organisms were also present. Other investigations showed that the intestinal content of infants contain both *B. aerogenes* and *B. coli* as soon as 18 hours after birth.

Methods used for safeguarding the water supply for army troops and camps were described by James W. Engle, War Department, Washington, D. C. The attention paid to this important phase of sanitation has been one of the factors responsible for the decrease of disease in the army; Mr. Engle reported that since 1898 the typhoid fever rate was lowered from 141.6 to 0.03 per 1000 in 1935 and that dysentery was reduced from 3.62 to 1.35 per 1000 in 1935—in 1933 the rate was only 0.54. Water treatment methods used in permanent camps follow general practice in municipal plants. In places where sea gulls frequent reservoir basins they have been discouraged from resting by the simple expedient of stretching wires across the basin to form 50-ft. squares.

Field treatment units

The quantity of water consumed by army troops varies widely depending on the type of camps and whether or not the troops are engaged in maneuvers or combat. At an army post during peace time the water supply demand may vary from 100 to 200 gal. per capita; semi-permanent or temporary camps make provisions for 25 to 35 gal. Troops on maneuvers require 2 to 5 gal. per man, but when in actual combat physical efficiency can be maintained for three days on from 3 pints to 2 quarts per day. Mobile water purification units are used in the field. Each unit, composed of a pressure filter and chlorinating apparatus mounted on a truck, can treat 4,200 gal. of water per hour. When the units are not available in the field, the "lyster-bag" is used. This is a heavy canvas or rubberized bag with a capacity of 36 gal. which serves 100 men. Water to be sterilized is first strained through a blanket to remove suspended matter and then poured into the lyster-bag where calcium hypochlorite is added. The hypochlorite is furnished in glass ampules containing enough chemical to treat one bag with 2 to 2.4 parts per million of chlorine.

Sewage treatment progress

R. C. Beckett, state sanitary engineer of Delaware, reported that in his state 60 per cent of the total population was available to sewer connections but only 11 per cent of the total sewage flow was treated. A description of the Dover combined sewage treatment plant and incinerator, one of the newest installations in the state, was given by Francis S. Friel, consulting engineer of Philadelphia. Investigations on chemical precipitation at the Hagerstown (Md.) sewage treatment plant were described by H. W. Rhodes, superintendent.

Other papers at the conference dealt with experiences in the Ohio River flood areas, distillery wastes and sewage treatment, water filtration, air conditioning, and the activities of the Interstate Commission on the Delaware River basin.

Officers elected for the coming year were Edward S. Hopkins, president; C. J. Bruce and A. M. Tawney, vice presidents; and A. W. Blohm, secretary-treasurer.

Two New Tunnels Authorized By New York Legislature

Governor Lehman of New York on May 7 signed a bill authorizing the New York State Tunnel Authority to build a tunnel under New York Bay from Staten Island to Brooklyn. The bill permits the authority to increase its outstanding bonds from the present authorization of $60,000,000 to $200,000,000.

The Governor also signed a bill authorizing the tunnel authority to construct a vehicle tunnel across Manhattan connecting the Queens Midtown Tunnel and the Lincoln Tunnel, both of which are now under construction. Cost of the proposed crosstown tube is estimated at about $27,000,000.

New England Building Code

(*Continued from page 720*)

which four-hour protection to the primary frame and three-hour protection to the secondary frame is furnished. Semi-fireproof buildings must furnish three hours' protection for the primary and one hour for the secondary frame.

Detailed classifications according to occupancy are made, and height restrictions are based upon these classifications. The classes set up are: 1. Buildings in which the protection of human life is important, the allowable area of this class of building being greater as the number of stories decreases; 2. Industrial buildings, with various degrees of hazard specified and the effective accessibility weighed from the fire protection point of view; 3. Habitations, subdivided into those housing more and less than three families; and 4. Miscellaneous.

In addition to giving specified proportions of aggregate in concrete, the code provides an alternative in the use of controlled concrete as specified by the engineer or contractor, with provision for test.

Provision for amendment

To keep the code responsive to progress and local needs, the Building Officials Conference voted that the incoming president shall appoint a standing committee of 25 members to be known as the Building Code Committee. The duty of this committee will be to study matters relative to proper building practice which are brought to its attention, particularly new developments, appliances, materials and methods of design and construction, and proposed amendments to the code. After a study of any proposal the committee will grant a hearing to the one making the proposal, if he so desires. Findings and recommendations will then be reported to the conference at the next meeting.

Mr. Roemer has been chairman of the building code committee since the beginning of work on the tentative code, and has been president of the conference through most of this period. Among those who took an important part in preparing the code are Arthur N. Rutherford, chief inspector of buildings, New Britain, Conn., (president of the conference 1934-5), P. F. Healey, inspector of buildings, Commonwealth of Massachusetts (president, 1935-6), and William J. Ennis, supervisor of buildings, Hartford, Conn., (president, 1936-7).

New Engineer Head At Purdue

W. K. Hatt will retire after 40 years service and R. B. Wylie will be new head of engineering school

Professor Ralph B. Wylie will become head of the School of Civil Engineering and director of the Materials Testing Laboratory at Purdue University at the end of the present academic year, replacing Dr. W. K. Hatt, who will retire from these posts to devote the following fifteen months, or until his permanent retirement, to directing the highway research project handled by the University for the Indiana Highway Commission.

The retiring head

A specialist in concrete construction, Professor Hatt is the author of numerous books and articles on the subject, including the Laboratory Manual for Testing Materials, the section on materials of the American Mechanical Engineer's Handbook, and the article on concrete construction in the Encyclopédia Americana; he is also joint author of "Concrete" and "Concrete Work." He has been connected with the engineering department of Purdue University for more than 40 years, and the school of civil engineering has attained its high rank under his general direction during that time.

Dr. Hatt was graduated from the University of New Brunswick at Fredericton in 1887 and obtained a master's degree there in 1898 and a degree of doctor of philosophy in 1901, but obtained his professional degree in 1891 from Cornell. He taught briefly at the University of New Brunswick and Cornell University, coming to Purdue in 1892 as associate professor of civil engineering. Two years later he became professor of applied mechanics, and in 1906 he became professor of civil engineering and director of the testing materials laboratory.

In addition to his duties at Purdue, Dr. Hatt has served since 1922 as state engineer for the Conservation Department and has been called upon to fill many important posts, among them that of consulting engineer for the Indiana War Memorial Commission; chief engineer for the Indiana Flood Commission in 1915; member of the joint committee on concrete and reinforced concrete; director of timber investigations for the U. S. Forest Service and of the advisory board on highway research for the National Research Council, and member of the consulting board on concrete for Boulder Dam.

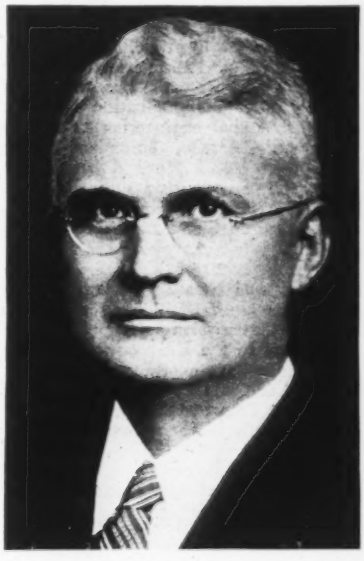
Dr. Hatt is a past-president of the American Concrete Institute and of the Indiana Engineering Society. He holds the Fuertes gold medal of Cornell University and the Turner gold medal of the American Concrete Institute.

The new head

Professor Wylie was graduated from the School of Civil Engineering at the University of Michigan in 1906. Since that time he has served at Purdue as professor of hydraulic engineering and sanitary engineering and since 1916 has been in charge of all the instructional work in hydraulic, municipal and sanitary engineering. He has served as active head of the school on various occasions during the last 18 years, while Dr. Hatt has been on leave of absence in connection with his outside duties. Professor Wylie has also spent

W. K. Hatt

numerous summers on public projects as chief or consulting engineer. Among these were a large project in Detroit; a water purification plant in the same city; sewage plant in Elgin, Ill.; reports for the Peru Flood Committee and Patock Levee, project; work as office engineer for the Indiana Flood Commission, and sewage or



Ralph B. Wylie

water purification problems for many Indiana towns and cities.

The new head is the author of several publications in the field of sanitary engineering and a member, among many other learned societies, of the American Society of Civil Engineers, the Society for the Promotion of Engineering Education, the American Water Works Association, the Central Station Sewer Association, and the Indiana Engineering Society.

Hindenburg Burns At Lakehurst

Thirty-five die as German dirigible catches fire at moment of mooring at New Jersey airport

The great airliner *Hindenburg* was destroyed by fire on May 6 just as the ship was about to be tied to the mooring mast of the naval air station at Lakehurst, N. J., at the end of its first transatlantic voyage this year. To date, 35 of the total of 97 passengers and crew lost their lives. The cause of the accident is unknown, but it is believed the backfire from the reversed engines set fire to hydrogen gas that had been released in bringing the airship down to the ground.

Details of the accident have been so widely published in the daily newspapers that they are omitted here. From what is known, it appears evident that this accident did not find its origin in structural weakness, as was the case in the wrecking of most of the earlier crafts of this type. Indirectly, however, structural safety has a bearing on the present accident, for it was the need for greater strength that resulted in a decision to use hydrogen exclusively to provide bouyancy for the *Hindenburg*.

Despite the higher cost of helium, the *Hindenburg* was built originally with outer doughnut-shaped gas containers, which were to be filled with helium, surrounding the central hydrogen compartment. But the use of helium was abandoned for three reasons: (1) the success of trial trips with hydrogen in both the inner and outer compartments, plus experience in earlier ships, gave the Germans confidence in their technique in safe handling of hydrogen; (2) the total lift with hydrogen is greater by 10 or 12 per cent than with helium; (3) the *Macon* and *Hindenburg* designs were the same, and after the *Macon* wreck experts agreed that the upper fins were not strong enough to withstand violent air disturbances; as a result the *Hindenburg* fins were strengthened, involving the addition of several tons weight. This additional weight cut into the pay load enormously, and the high premium on trans-Atlantic pay load capacity was so important a factor that the decision was reached to use hydrogen exclusively.

Earthquakes at Boulder Dam May be Caused by Lake

Earthquakes at Boulder Dam have been frequent of late. On April 28 and 29 there were eight in two days. The intensities of some of these were estimated to be 4 or 5 on the Rossi-Forel scale. Sounds like explosions or blasts have accompanied the quakes.

Because of the frequency of shocks since Lake Mead has begun to fill and the inference that this new water load on the earth's crust may be causing the quakes, suggestion has been made that the U. S. Coast and Geodetic Survey install a group of instruments for studying these seismic disturbances. One instrument at the Dam and one on either side of the lake some distance up-stream from the Dam would form a roughly equilateral triangle with which an attempt could be made to locate the epicenters of the shocks for comparison with the water load in the lake.

War Department Appropriations

Washington correspondence

Hearings were completed this week on a composite appropriations bill providing for non-military activities of the War Department during the fiscal year beginning July 1, 1937, and covering river and harbor improvements as well as flood control projects. The House Committee on Appropriations is expected to report the bill in the near future.

While the exact amount of federal money allocated to the various purposes will not be known until a bill is reported, it is believed that budget allowances will be the determining factor. The 1938 budget approved expenditures for new construction as follows:

River and harbor improvements....	$90,822,101
Flood control (omnibus bill).....	30,000,000
Flood control (Mississippi system)..	22,500,000

In addition, the budget recommends $37,177,899 for maintenance work on rivers and harbors, and makes provision for the continuation of work on a number of projects already started.

These funds, when appropriated, will be for prosecuting work on projects already authorized by Congress. Two bills last year—the omnibus and Overton bills—listed totals of $300,000,000 and $270,000,000 in authorized projects, respectively. An additional list believed to total nearly $800,000,000 (including local contributions) on the Ohio and Mississippi systems has been prepared by the Chief of Engineers, but its consideration by Congress is being delayed pending clarification of the Administration's attitude toward the opposing objectives of federal economy and comprehensive flood control. The latter is exemplified by Senator Norris' announced intention to cover the country with eight TVA-type regional organizations charged with responsibility for flood control, navigation improvements, power development, soil erosion prevention, reforestation, reclamation, and all other uses of water.

Still another complication is provided by the uncertainty of the President's plan for reorganization of the executive departments, somewhat neglected of late but due for much discussion before Congress adjourns.

Treasury Department's Staff Drastically Reduced

Because of curtailed activities in federal building construction, the Procurement Division of the U. S. Treasury Department has announced the dismissal of 206 emergency technical employees, effective May 15. The list of those dismissed includes 21 structural engineers, 41 mechanical and electrical engineers, and 144 architects. The present reduction in the force of emergency technical employees leaves 295 workers still employed.

These changes do not affect the permanent staff of technical employees or the 21 temporarily employed architectural engineers. The permanent staff now numbers 177 architects, 58 structural engineers, 55 mechanical and electrical engineers, and 28 architectural engineers.

Passage of N. J. Water Bills Unlikely This Session

The Loizeaux bills pending in the New Jersey Legislature (*ENR* March 11, 1937, p. 388) which would provide for coordination of the activities of the North Jersey District Water Supply Commission and the Jersey State Water Control Commission appear dead for this session. Senator Loizeaux, as chairman of the Judiciary Committee, which has custody of the bill, said today that he does not plan to hold public hearings on the measure. A hearing was set tentatively some time ago but later was postponed indefinitely. Senator Loizeaux stated that Democrats in the Assembly had refused their support to the water bills, and since there was no possibility of passage it has been agreed not to move them.

The proposed legislation would have eliminated overlapping jurisdiction of the two water control agencies, placing the determination of policy for the financing of projects in the hands of the Water Policy Commission and leaving to the North Jersey District Commission duties concerned primarily with construction and operation of undertakings.

Crawford to Head Engineering At University of Kansas

Ivan C. Crawford, dean of the College of Engineering of the University of Idaho, has been appointed dean of the School of Engineering and Architecture at the University of Kansas, the appointment to become effective next fall. He succeeds the late George C. Shaad who died last July.

Dean Crawford was graduated in 1912 from the University of Colorado and three years later received the professional degree of civil engineer from that institution. Immediately after his graduation he became instructor in civil engineering at the University of Colorado, becoming assistant professor in 1916. He had been gaining field experience summers in work for the Illinois Central, the Denver & Rio Grande and the Oregon Short Line Railroads.

He served during the war with the 115th Engineer Regiment of the U. S. Army, first as captain and then as major. He was chief of the general building section of the American Commission to negotiate peace.

Returning to the University of Colorado he became associate professor of civil engineering, and in 1922 professor and acting head of the department.

A year later, Dean Crawford went to Idaho as dean of the College of Engineering, and in 1928 he became director of the Idaho Engineering Experiment Station.

Steel Development Congress To Be Held in France

The Sixth International Congress for Steel Development which was scheduled to meet in New York this June but was cancelled will be held in France this summer, June 22-26. A call for this meeting has just been issued from the executive offices in the Hague, Holland, and delegates have been asked to meet in Duesseldorf, Germany on June 21 for a preliminary conference and to view the crafts exhibition.

SOCIETY CALENDAR

BUILDING OFFICIALS CONFERENCE OF AMERICA, national convention, Cleveland, Ohio, May 31–June 4.

AMERICAN WATER WORKS ASSOCIATION, annual convention, Buffalo, N. Y., June 7-12.

ENGINEERING INSTITUTE OF CANADA, semi-centennial celebration, Montreal and Ottawa, Canada, week of June 15.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, summer convention, Milwaukee, Wis., June 21-25.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, annual meeting, Cambridge, Mass., June 28-July 2.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, New York City, June 28–July 2.

AMERICAN WATER WORKS ASSOCIATION, PACIFIC NORTHWEST SECTION, Victoria, B. C., May 20-23; NEW JERSEY SECTION, Newark, N. J., May 21.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, MIDDLE ATLANTIC SECTION, spring meeting, New Brunswick, N. J., May 15.

NORTH CAROLINA INDUSTRIAL SAFETY CONFERENCE, Winston-Salem, N. C., May 20–21.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS, annual meeting, New York City, May 22.

PENNSYLVANIA SEWAGE WORKS, Annual conference, State College, Pa., June 21-23.

LICENSE EXAMINATIONS

NEW YORK: Examinations for registration of professional engineers and land surveyors will be given by the New York State Board of Examiners July 6, 7, and 8 at Albany, Buffalo, New York, and Syracuse. It is expected that assignments to these examinations will be limited to candidates who filed their applications before Jan. 1, 1937.

A. P. Cooper was recently elected president of the SOUTHERN OHIO SOCIETY OF PROFESSIONAL ENGINEERS. Clyde E. Haskar was elected treasurer.

The new president of the NEBRASKA ENGINEERING SOCIETY is John C. Detweller. Roy M. Green is vice-president, and new members of the board of directors include Lee Nelson, C. W. Minard, John Hogue, T. L. Franks, and O. J. Ferguson.

The newly elected officers of the ENGINEERS SOCIETY OF PENNSYLVANIA are: president, John B. Warden; first vice-president, Irvin H. Geiger; second vice-president, E. Clark Cowden; secretary, Guy T. Loehner; financial secretary, P. W. Woodring; treasurer, Ross H. Swope; and directors, Frank A. Robbins, Jr., W. F. Miller, and H. E. Moses.

Too High Bids Are Rejected On Cincinnati Housing

Rejection of all bids for the construction of two additional buildings for Laurel Homes, $7,000,000 PWA housing project in Cincinnati, has been ordered by PWA Administrator Ickes. New bids are to be taken at once. The low bid of $608,000 for the construction of the two fireproofed 114-unit apartments was considerably above the estimate prepared by the housing division.

Foundations for the originally planned nineteen buildings of the project are completed, and work on the erection of superstructures is progressing. When completed the development will provide dwellings for 1,039 families.

Brief News

A PWA GRANT of $431,500 provides for the construction of four 300-bed hospital units in Puerto Rico at an estimated cost of $940,000. The grant is based on the estimated cost of relief labor plus 15 per cent for overhead.

REQUIREMENTS for registration of Iowa engineers are increased by a bill passed by the Iowa Legislature. Under the new law applicants for licenses must have an engineering degree and two years of experience or must have six years' experience and pass an examination.

THE CHESAPEAKE & OHIO vehicle bridge across the Ohio River between Covington and Cincinnati is to be purchased by the state of Kentucky for $2,100,000. The bridge will be made toll-free as soon as toll receipts liquidate 3 per cent revenue bonds to be sold by the state to finance the purchase. Gross revenues from the bridge totaled $360,000 last year and net income exceeded $280,000.

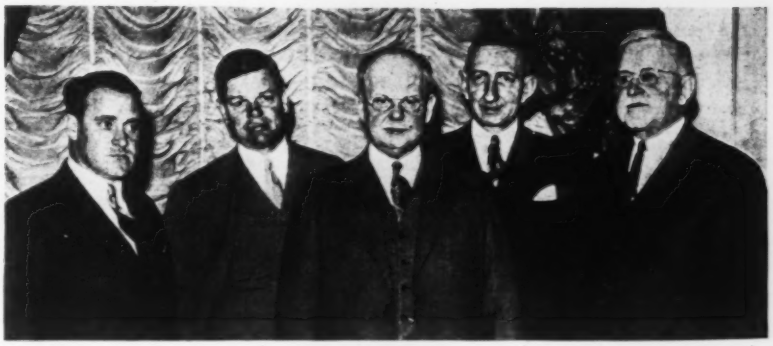
RAILROADS entering New Orleans have been warned by Mayor Maestri that unless they soon make voluntary plans for the erection of two union stations, the city will take formal steps to force grade crossing elimination and new station construction. Under the city charter the municipality would carry 35 per cent of the grade separation cost. Plans have been discussed for new stations and grade separation for a number of years.

THE PROFESSIONAL LIBRARY of the late John H. Gregory, consulting engineer, which was presented at his request to the city of Columbus, Ohio, as an expression of appreciation of the confidence placed in him during his 22 years of service with the city was formally opened and dedicated as the John H. Gregory Sanitary and Municipal Engineering Reference Library on May 7. The library is now located in the City Hall Building.

WILLIAMSBURG HOUSES, PWA's $13,569,000 housing project in New York City, is increased by two additional buildings under a $757,000 contract awarded by PWA to Starrett Bros. & Ecken, contractors on the entire project. The two added buildings have been held up pending acquisition of title to land, but now that the land has been purchased the two new buildings will add 151 living units to the project, bringing the total to 1,622.

LAKE MEAD, the lake created by Boulder Dam, now contains 11,000,000 acre-feet of water, Commissioner of Reclamation Page reported May 5. This represents a gain of 1,000,000 acre-feet in a month. It continues to appear probable that sufficient water will be stored in the lake by June 1 to warrant a shift of the power generation at the Boulder Dam power plant to a firm power basis. This will mean tripling the revenues to the government from the plant.

REWRITING of the Baltimore building code, which has been in effect since 1908, with revisions made in 1924 and 1927, has been authorized by the Baltimore Board of Estimate. The revision work is expected to take about two years. William A. Parr, building engineer and head of the Bureau of Buildings, has been authorized to engage three engineers and other necessary personnel to perform the work. The activity will be under the immediate supervision of John M. Russell, building construction engineer in the Bureau of Buildings, and will be directed by officials of the Department of Public Works.



NEW ENGLAND ROAD BUILDERS MEET

SOME of the officers present at the Boston meeting of the New England Road Builders Association April 27. Left to right are: Louis R. Perrini, treasurer; A. P. Lawton, director; E. Raymond Newell, vice-president; Frederick Hoitt, secretary, and David A. Bridge, director.

Vigorous opposition was expressed at the meeting to gasoline tax diversion and to the use of the WPA on highway construction. Speakers favored highway construction by experienced contractors and unified surveying and planning of desirable highway routes on a regional basis.

Officers elected for the coming year are: C. J. Maney, president; E. Raymond Newell, vice-president; Louis R. Perrini, treasurer, and Frederick Hoitt, secretary. A new director, Joseph P. McCabe, was chosen.

LOW BIDDER on Section 6 of New York City's Sixth Avenue Subway was Spencer, White, and Prentis, New York City, with a bid of $6,960,000. Del Baso Contracting Co., New York, bid $7,800,000, and the Underpinning and Foundation Co., also of New York, bid $9,400,000. This is the last section of the Sixth Avenue Subway; all other sections are now under contract. The work consists of construction of two single-track shield tunnels to be driven under compressed air.

STRENGTH of the new Washington state highway code was evidenced last week when state highway director Murrow refused to approve the expenditure of the state gas tax funds in Kings County for county highway official salaries which he declared were excessive. "It is hardly conceivable," Mr. Murrow stated in a letter to the county commission, "that an engineering expenditure in excess of $12,000 a month is necessary to perform the services essential in the proper handling of road work in Kings County."

Personals

CHARLES H. BEAL, formerly director of operation, WPA, in charge of the Thirteenth St. reconstruction work in Omaha, Neb., has been appointed chief engineer for Nebraska District No. 1, WPA, with headquarters at Norfolk.

CHARLES A. HARRELL, former city manager of Binghamton, N. Y., has been appointed city manager of Schenectady, N. Y., succeeding LEROY C. PURDY, who has accepted a temporary appointment as city engineer, a position vacant during his term as manager.

ROBERT H. KIRKWOOD has resigned as assistant engineer of the Bureau of Reclamation in Denver to accept a position as personnel officer with the Tennessee Valley Authority.

LT. COL. CHARLES F. WILLIAMS, U. S. District Engineer, Portland District, in charge of Bonneville Dam construction since its authorization, has received orders from the War Department to report to Fort Leavenworth, August 1, for duty as senior instructor in the Command and General Staff School. Previous orders had directed Col. Williams to report to Fort Bevoir, Va.

J. E. ST. LAURENT, formerly district engineer of Ottawa for the Canadian department of public works, has been appointed chief engineer of the River St. Lawrence ship channel, Department of Transport, Montreal, Que., succeeding Major N. B. MCLEAN, in the government service for 45 years, who will be retained as adviser. FREDERICK S. JONES has been appointed assistant chief engineer in the post left vacant by the death of Alfonse Lafleche.

ALEXANDER H. RUDD, chief signal engineer for the Pennsylvania R. R. retired March 31, having reached the full age of 70 years. Mr. Rudd entered the Pennsylvania service immediately after his graduation in 1886 from the Sheffield Scientific School of Yale University, serving as draftsman first in the real estate department and later in the signal department. He left the Pennsylvania in 1892 and did signal work on the New York Central, the New Haven and the Lackawanna, returning to the Pennsylvania eleven years later as assistant signal engineer on the lines east of Pittsburgh. He became signal engineer in 1907 and in 1920 was made chief signal engineer of the entire system. Mr. Rudd is

credited with being one of the originators of the "position light" signals now in general use, and he pioneered in the introduction of cab signal devices on the Pennsylvania. As chairman of the committee on highway protection, signalling section, American Railway Association, Mr. Rudd was largely instrumental in the design and adoption of the standard flashing light signal now used throughout the country as a warning at railroad grade crossings. He is a past-president of the Yale Engineering Association and the American Signal Association (now incorporated in the Association of American Railroads) and is a life member of the A.A.R. In 1910 he was elected the first foreign honorary member of the Institution of Signal Engineers in Great Britain.

Obituary

TYDOR BISZKO, building contractor at Fall River, Mass., died there May 5 at the age of 54, after 21 years in the construction business in Fall River.

R. ADAMS DAVY, a pioneer civil engineer of the Canadian Pacific Ry. and one of the founders of the Engineering Institute of Canada, died May 1 in Ottawa at the age of 86.

ARTHUR L. MUDGE, formerly chief electrical engineer for the dominion government on the Welland Canal works, died in Toronto April 29 at the age of 64. Before his work on the Welland Canal, from which he retired three years ago, Mr. Mudge was connected with the consulting engineer firm of Kerry & Chase, Toronto.

GEORGE W. LAWES, 80, New Orleans engineer and businessman, died there on April 27. Mr. Lawes was associated with Eads in the construction of the jetties at the mouth of the Mississippi River and served as secretary of the Louisiana State Board of Engineers for 20 years, from 1901 to 1921.

CHARLES G. PALMER, 67, formerly district engineer for the Austin Co., of Cleveland, designer of one of the locks for the Panama Canal, and engineer in charge of construction of the Russian city of Nijni Novtorod, died recently in East Cleveland, Ohio.

GEORGE BENJAMIN SMITH, who retired in 1931 as senior engineer of the Boston Street Department, died May 7 at his home in Boston at the age of 76. He became assistant engineer for the department in the Brighton and Roxbury districts about 46 years ago and was made senior engineer in 1922.

WILLIAM A. BORING, dean emeritus of the Columbia University School of Architecture, died in New York City last week at the age of 77. Dean Boring was head of the School of Architecture from 1915 to 1933. He had practiced in Los Angeles for several years in the '80s, and in New York he practiced as a member of the firm of McKim, Meade & White and later in association with Edward L. Tilton.

LARGER AWARDS FOR THE WEEK

Plant, Acme Steel Company, Riverdale, Ill.	$1,000,000
Power plant, New York State Electric and Gas Corporation, Dresden, N. Y.	2,000,000
Residential development, Gross-Morton, Inc., Bayside, N. Y.	500,000
Apartment, 391 East 149th Street, P. and A. D. Rubin, Inc., New York, N. Y.	500,000
Store building, Lit Brothers, Upper Darby, Pa.	1,000,000
National Gallery of Art, A. W. Mellon Charitable and Educational Trust, Washington, D. C.	10,000,000
Superstructure of hospital for chronic diseases, Welfare Island, New York, N. Y.	6,028,000
Federal jail, Sandstone, Minn.	687,000
Highways, Texas	1,485,000
Highways, North Dakota	599,000
Highways, North Carolina	904,000
Highways, Wisconsin	616,000
Foundations and ramps, Flushing River Bridge, Flushing, N. Y.	543,000
Ocean outfall main, Miami Beach, Fla.	943,000
Dredging Cape Cod Canal, U. S. Engineers, Mass.	669,000
Dredging channel along New Jersey Pier Head Line, Upper Bay, New York Harbor, N. Y. and N. J.	567,000
Construction of first section of Bingham-Tooele Tunnel, National Tunnel and Mines Company, Tooele, Utah	700,000
Camp and resort on Eagle Lake, W. Hockschild, Utica, N. Y.	500,000

INDEX NUMBER

ENR Cost = 100	1913 = 100	1926 = 100	ENR Volume = 100	1913 = 100	1926 = 100
May, 1937	232.65	111.85	Apr., 1937	161	71
Apr., 1937	230.25	110.64	Mar., 1937	147	64
May, 1936	203.40	97.77	Apr., 1936	166	73
1936 (Av.)	206.46	99.24	1936 (Av.)	185	81
1935 (Av.)	195.22	93.84	1935 (Av.)	135	58
1934 (Av.)	198.10	95.23	1934 (Av.)	114	50

CONTRACTS
(Thousands of Dollars)

	Weekly Average May 1936	Weekly Average Prev. 4 Weeks	Week May 13 1937
Fed. Government	$3,008	$2,921	$4,492
State and Municipal	22,797	21,563	27,745
Total public	$25,805	$24,484	$32,237
Total private	9,509	23,254	30,464
Week's total	**$35,314**	**$47,738**	**$62,701**
Cumulative to date:			
1936 (20 weeks)			$865,819,000
1937 (19 weeks)			$858,169,000

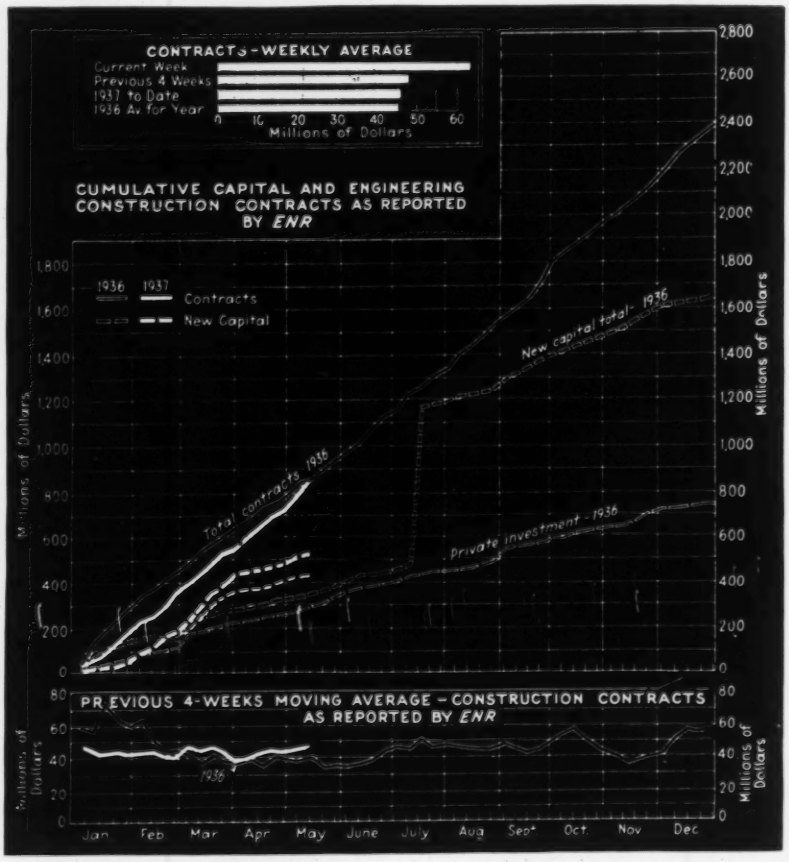
Note: ***Engineering News-Record*** **reports waterworks and earthwork, reclamation or** waterways projects of $15,000 and over in size; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000 and over. The figures above represent the **volume of contracts and large force account** projects throughout the U. S. that are of **these minimum sizes or over.**

NEW PRODUCTIVE CAPITAL
(Thousands of Dollars)

1937	Week May 13	Cumulative
Private investment	**$6,017**	**$441,909†**
State and municipal bonds	2,518	212,243†
Corporate securities	3,499	229,666
Federal financing	....	**$78,517†**
PWA non-federal Projects	....	48,585†
R.F.C. Loan	....	29,932
Total non-federal	**$6,017**	**$520,426**
Federal projects	....	.....
Total	**$6,017**	**$520,426**
Cumulative to date:		
1936 (20 weeks)		$373,082,000
1937 (19 weeks)		$520,426,000

Note: These figures include private bonds and stocks sold for new construction purposes; state and municipal bonds for construction; PWA loans and grants to states and municipalities, RFC direct purchase of bonds for "self liquidating" projects, and 25 per cent of WPA construction appropriations.

† Includes transfer from federal to private investment financing through sale by RFC of PWA bonds.


CONTRACTS - WEEKLY AVERAGE
Current Week
Previous 4 Weeks
1937 to Date
1936 Av. for Year
0 10 20 30 40 50 60
Millions of Dollars
CUMULATIVE CAPITAL AND ENGINEERING CONSTRUCTION CONTRACTS AS REPORTED BY ENR
1936 1937
Contracts
New Capital
New capital total-1936
Total contracts 1936
Private investment-1936
Millions of Dollars
PREVIOUS 4-WEEKS MOVING AVERAGE - CONSTRUCTION CONTRACTS AS REPORTED BY ENR
1936
Millions of Dollars
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

Construction Equipment and Materials

Polish Reinforcing Bar

A new type of deformed concrete reinforcing bar called Griffel-stahl, invented in Poland, is being introduced into this country by Conrad Wolff, Box 448, Newark, N. J.

The bar is wide at the edges and narrow in the center. Lugs are placed at intervals along its length joining the thick portions. This shape is stated to provide the same bond strength with only two-thirds of the weight of steel required in the round bar. It is available either straight or twisted.

The distributor states that since the price of the grade of steel used in Griffel-stahl is only slightly higher than that in ordinary reinforcing bars, a net saving of about 20 per cent is provided over the cost of the standard bar. The ordinary design tables of properties of round shapes, it is stated, can also be used for Griffel-stahl bars.

Buckeye Announces Line Of Excavators

The Buckeye Traction Ditcher Co. of Findlay, Ohio, has placed on the market a line of ½, ⅝, and ¾ yd. excavators with shovel, crane, dragline, clamshell, and trench hoe attachments. The new machines are known as Buckeye Clippers, models 50, 60 and 70.

The new excavators incorporate an exclusive system of control by metered vacuum. All operations are controlled from a simple control panel carrying small easily moving levers. The manufacturer states that this control system, the product of an automotive equipment manufacturer with national service facilities, provides complete freedom from trouble due to extremes of temperature, small leaks, or water in the line. Automatic vacuum control brakes are also provided.

The comfort of the operator has been given a good deal of attention in these machines; the cab, which contains a hot water heater as standard equipment, provides an air cushioned seat, a convenient tool rack, and compartments for personal articles.

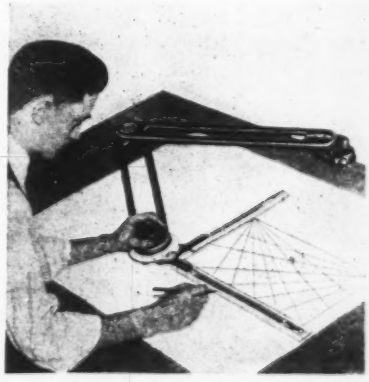
A tubular dipper stick, 100 per cent electric alloy steel, anti-friction bearings, heat treated shafting, are features of the design of this machine.

Electric Bitumen Heater

An electrically powered bitumen heater known as the Easton-Clarmac is being introduced in this country, under license from an English concern, by the Easton Car & Construction Co., Easton, Pa. The heater is a rectangular steel tank equipped with electric heating elements uniformly spaced at the bottom of the tank and varying in number according to the size of the tank. The elements are controlled by a sensitive thermostat which automatically maintains the desired temperature of the bitumen.

Heated bitumen is delivered by a gear type pump, submerged in the bitumen just above the heating elements, driven by a vertical reversible motor located on top of the tank. The supply pipe to the mixer is of the return type so that, although the pump operates continuously, bitumen not drawn off is returned immediately to the heater. At the end of the day's run the pump is reversed and the pipe line emptied and the pump is then turned off for the night.

The Easton-Clarmac heater is manufactured in any desired capacity. The 3,000 gal. heater is about 7 ft. by 7 ft. by 10 ft.



New K&E Drafting Machine Has One Hand Control

A new drafting machine, the K&E Paragon, controlled entirely by the left hand has been developed by Keuffel & Esser Co. of Hoboken, N. J. The Paragon machine consists of a jointed arm of aluminum alloy carrying a protractor head fitted with two scales set 90 deg. apart. Parallel motion is maintained by steel bands under constant tension concealed within the arm section. All moving parts turn on ball bearings.

The protractor head may be set to lock at any angle, to move freely in angular displacement, or to stop automatically at every 15 deg. The locking and stop mechanism is operated by a single lever under the left thumb of the operator, so that the entire device, it is said, can be operated and controlled by the left hand only.

Scales, which are interchangeable, are furnished either as the conventional white edge scales or in a series of special scales made of aluminum alloy with hard black surface and white graduations and numbers. The aluminum scales are said to be impervious to atmospheric changes.

The machine is offered in two models: a standard type with a spring counterbalance to prevent accidental motion, for use on drawing boards at any angle up to 15 deg.; and a vertical type, with a weighted counterbalance, that can be used in any position of the board from horizontal to vertical.

Road Marker

A new device produced by the Lumin-Arey Corp., 515 Main St., Cincinnati, Ohio, is intended to indicate center lines of highways or to mark warning signs in the pavement. It consists of a cast iron button 3¼ in. by 3¼ in. rendered conspicuous by a stainless steel shell. The marker, which is held to the road by a notched lug to be driven or cast into the pavement, rises to a height of ¾ in. above the pavement in three streamlined steps.

Reflection from the edges of the steps is said to render the marker readily visible at night as well as in the daytime, and the streamlined shape is stated to be self-cleaning.

New Equipment in Brief

Plaster mixer—A small mixer for plaster and mortar built in 6- and 10-cu.ft. sizes by the Ransome Concrete Machinery Co. of Dunellen, N. J., is said to be able to keep 18 to 30 plasterers well supplied with plaster. The mixer, trailer mounted, can be handled by one man, it is stated.

Bucket—The new Model E-16 clamshell rehandling bucket is stated by The Hayward Co., 50 Church St., New York, N. Y., to present important improvements in the power wheel bucket. The cutting edges are wider and the one piece shell is made of alloy steel; the welded steel upper center with manganese steel throat and idler sheave is made integral with one set of connecting rods. The bucket is furnished in capacities from ½ to 4 cu.yd.

Tires—Truck tires, known as "Earth Movers," designed for heavy service in the mining and construction field, have been developed by The B. F. Goodrich Co. of Akron, Ohio. These tires, with a capacity of 15,740 lb. per casing, are mounted on 13 in. rims, weigh 449 lb., and are available in 12, 16, and 20 ply. The tires are available in two types of treads, one for trailer use on free moving wheels, and the other with a traction tread for use in mud and soft ground.

Belt Carrier—A belt carrier which is said to show unusually long life under heavy impact, and also to increase the life of the belt, is being marketed by the Stephens-Adamson Manufacturing Co., of Aurora, Ill. It is intended to be used under loading points, in belt feeders, and under the entire length of movable shuttle conveyors. It consist of three rollers, the outer roller tilted to give a 20-deg. trough, made up of 21-in. steel hubs surrounded by a 1⅛ layer of vulcanized rubber.

Magneto—A new product of the Edison-Splitdorf Corporation, of West Orange, N. J., the Edison R. M. Magneto, is said to be smaller, lighter and less expensive than other magnetos of the same output and efficiency. It is of the rotary magnet type with fixed spark, built for base or flange mounting. A new magnetic material, Alnico, has been used in the rotors of the R.M. The circuit breaker is gear-driven, operating at only one-half to one-third the speed of magnetos of conventional design. The impulse starter is the same unit used in larger Edison magnetos.

Manufacturers Activities

✦ A new company, RUBBER ASSOCIATES, INC., 342 Madison Ave., New York City, has been organized to engage in the manufacture of chemical products and plastic materials for all phases of construction projects and for manufacturing industries.

✦ PACIFIC WOOD TANK CORP., 461 Market St., San Francisco, Calif., has been formed by Fred W. Schmitz, Phil J. Maas and G. A. Patey, all formerly with Pacific Tank & Pipe Co. of San Francisco. The new company will provide an engineering, design and installation service on wood-stave tank and pipe products.

✦ The BANTAM BALL BEARING CO. of South Bend, Ind., has changed its name to the BANTAM BEARINGS CORPORATION. The change was made to indicate the broadening of the company's production from its concentration 40 years ago on ball bearings to the present condition in which more than 90 per cent of the company's business is devoted to the manufacture of taper roller and straight roller bearings. Bantam Bearings Corp. is now a subsidiary of the Torrington Co. of Torrington, Conn.

✦ The ARMSTRONG CORK CO., Lancaster, Pa., has purchased the Stedman Rubber Flooring Co. of S. Braintree, Mass., and is offering the former Stedman Rubber Tile as Armstrong-Stedman Reinforced Rubber Tile. A filament reinforcement has been added to the tile which is said to make it more dense and more resistant to abrasion besides adding to the tensile strength.

✦ Trackson-Lessmann front end attachments for wheel type industrial tractors, formerly produced by the Trackson Co. of Milwaukee, are now being made by the WHITE MANUFACTURING CO. of Elkhart, Ind. This transfer of manufacture and sales applies only to apparatus for use on tractors equipped with wheels and pneumatic tires. Equipment mounted on crawler tractors will be continued in production by the Trackson Company. The attachments will be known hereafter as White Front End Attachments.

✦ WODACK ELECTRIC TOOL CORP. has resumed publication of its house organ "Electric Tool Facts." The first issue came out some years ago but was never continued. It is planned to publish every month or so.

New Distributors

✦ GENERAL REFRACTORIES CO. has appointed H. W. Porter & Co., Inc., Newark, N. J., as their distributor in the Newark area for a complete stock of refractories.

✦ Voehck Equipment Co., 2404 W. Clybourn St., Milwaukee, Wis., has been appointed distributor of Lima Excavators in Wisconsin by the SHOVEL AND CRANE DIVISION of LIMA LOCOMOTIVE WORKS, INC., Lima, Ohio.

✦ The line of excavating equipment manufactured by the BUCYRUS-ERIE CO., S. Milwaukee, Wis., will be handled in the New York metropolitan area by the firm of Ginsberg & Horan, 355 Walton Ave., New York City. In Detroit, the Abrams-Anderson Co., 10425 Northlawn Ave., Detroit, Mich., has been appointed distributor for Bucyrus-Erie excavators.

✦ New distributor in the state of Montana for LITTLEFORD BROS., Cincinnati, Ohio, is the Hall-Perry Machinery Co., Butte, Mont. The Jeff Hunt Road Machinery Co., of Columbia, S. C., has been appointed Littleford agent in the state of South Carolina, and in Atlanta, Ga., the Southern Iron & Equipment Co. will handle Littleford products for the state of Georgia.

✦ Smith Booth Usher Co., 2001 Santa Fe Ave., Los Angeles, will distribute Internation Industrial Trac-Trac-Tors, wheel type tractors, and power units for all of Southern California and part of Arizona for the INTERNATIONAL HARVESTER CO., Los Angeles, Calif.

Personnel Changes

✦ A. R. Ellis, formerly vice-president of the PITTSBURGH TESTING LABORATORY, has been elected president, and C. M. Houck, formerly manager of the inspection division, has been elected vice-president.

✦ New president of the UNIVERSAL CRUSHER CO. of Cedar Rapids, Ia., is A. W. Daniels. H. F. Rikhoff has been elected secretary and treasurer.

✦ The JAMES H. TOWER IRON WORKS has announced the election of Fielding V. Jackson as president to replace the late Louis P. Tower.

✦ James G. Collins has been appointed sales manager of the RICHMOND SCREW ANCHOR CO., INC., 243 Bush St., Brooklyn, N. Y.

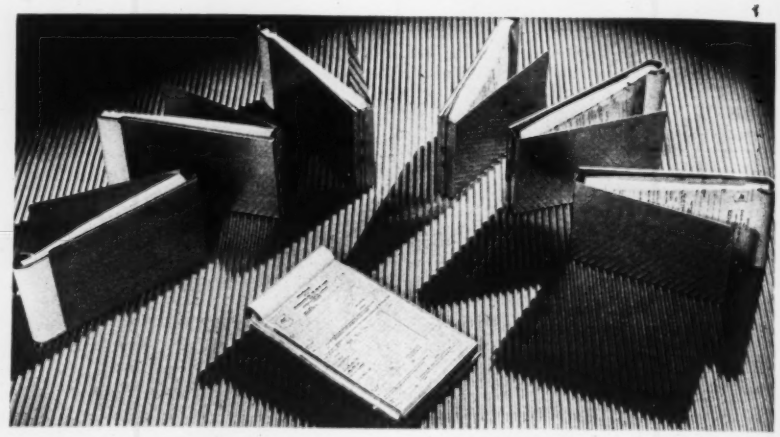
✦ Election has been announced of Alfred E. Gibson as president of the WELLMAN ENGINEERING CO., Cleveland, Ohio.

✦ E. R. Galvin has been appointed to the newly created post of general sales manager by the CATERPILLAR TRACTOR CO., Peoria, Ill.

Threadless Pipe Fittings

Cutting pipes to exact length, threading, grooving, clearing, or screwing up of joints are said to be unnecessary with the new line of Style 65 pipe fittings developed by the S. R. Dresser Mfg. Co., 424 Fisher Ave., Bradford, Pa. A plain end pipe is inserted in the new fitting, and it is only necessary to tighten two threaded octagonal follower nuts with a few turns of the wrench. As this is done, resilient armored gaskets at each end of the fitting are compressed tightly around the pipe forming a positive seal which is said by the manufacturer to absorb normal vibration and expansion and contraction movement and to permit deflection of the pipes in the joint. Pipe already threaded can be joined in the same way.

The line of Style 65 fittings include standard and extra long couplings, ells, and tees, all supplied in standard steel pipe sizes from ½ in. I.D. to 2 in. I.D., black or galvanized.



ALUMINUM NOTEBOOK COVER

THIS STITCHLOCK notebook cover, product of Radyite Products, 346 E. Walnut Lane, Philadelphia, Pa., is said to protect a notebook held in its spring clamp and to provide a firm writing surface. The aluminum cover is made in a variety of styles, most of which include a hinged cover which can be placed between the pages of the notebook to provide a writing surface. Several styles have back compartments to hold loose papers.

Portable Vehicle Counter

A portable device weighing only 42 lb. complete which will count and record the number of vehicles passing along a road for as long as eight days without attention has been developed by the Paver-Sills Co., 4101 North Ravenswood Ave., Chicago, Ill.

The device consists of a flexible strip laid across the pavement and a counting and recording device. The road strip, which is said to be completely inconspicuous due to its resemblance to an expansion joint, actuates the recording device, whenever a car passes over it, with such speed, it is said, that it can count vehicles within a few inches of being exactly abreast. The total number of vehicles is recorded on the recording tape once every hour.